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Income Distribution, Productivity and Stagnation: An Alternative to the ‘Secular Stagnation’- Narrative

Ludwig Antonio Nikolaus List

► **To cite this version:**

Ludwig Antonio Nikolaus List. Income Distribution, Productivity and Stagnation: An Alternative to the ‘Secular Stagnation’- Narrative. Sociology. Université Paris-Nord - Paris XIII, 2021. English. NNT : 2021PA131080 . tel-03887888

HAL Id: tel-03887888

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UNIVERSITÉ SORBONNE PARIS NORD

Doctoral School ÉRASME

University Department **Centre d'Économie de Paris-Nord (UMR CNRS 7234-CEPN)**

Thesis defended by **Ludwig Antonio Nikolaus LIST**

Defended on **29th June, 2021**

In order to become Doctor from Université Sorbonne Paris Nord

Academic Field **Economics**

Income Distribution, Productivity and Stagnation

An Alternative to the 'Secular Stagnation'-Narrative

Thesis supervised by Dany LANG

Committee members

<i>Referees</i>	Servaas STORM	Senior Researcher at Technical University Delft
	Mark SETTERFIELD	Professor at New School for Social Research
<i>Examiners</i>	Antonella STIRATI	Professor at Roma Tre University
	Donatella GATTI	Professor at Université Sorbonne Paris Nord
	Virginie MONVOISIN	Associate Professor at Grenoble École de Management
<i>Supervisor</i>	Dany LANG	Associate Professor at Université Sorbonne Paris Nord

COLOPHON

Doctoral dissertation entitled “Income Distribution, Productivity and Stagnation”, written by Ludwig Antonio Nikolaus LIST, completed on 4th July, 2021, typeset with the document preparation system \LaTeX and the yathesis class dedicated to theses prepared in France.

The Université Sorbonne Paris Nord neither endorse nor censure authors' opinions expressed in the theses: these opinions must be considered to be those of their authors.

Keywords: wages, productivity, wage-led, profit-led, verdoorn's law, meta-regression analysis, marx-webb effect

Mots clés : salaires, productivité, wage-led, profit-led, loi de verdoorn, analyse méta-régression, effet marx-webb

This thesis has been prepared at

**Centre d'Économie de Paris-Nord (UMR
CNRS 7234-CEPN)**



☎ 33 (0)1 49 40 32 55 / 35 27
✉ cepn-secretariat@univ-paris13.fr
Web Site <https://cepn.univ-paris13.fr/presentation-3/>

To Alexandra Elbakyan, who fights for the righteous cause

After sacrificing a chicken and shedding its blood on the external HD containing the data, the desperate AP (missing just one top-field for his tenure case) lights a couple of black candles and prays to the gods of econometrics to get a 0.049 instead of a 0.051, on which his future career, financial stability, mortgage, city of choice, and marriage, depend.

Economist '903c' on
econjobrumors.com, 15.11.2018

**INCOME DISTRIBUTION, PRODUCTIVITY AND STAGNATION
An Alternative to the ‘Secular Stagnation’-Narrative**

Abstract

Since the Global Financial Crisis in 2007, mainstream economics debate has revolved around the possibility of ‘secular stagnation’, that is, a prolonged period of no or very low GDP growth. Adherents of the secular stagnation-narrative usually find possible explanations in imperfect capital markets, demographic change and capital-saving rather than capital-using innovations. The aim of the present PhD thesis is to present an alternative to the secular stagnation-narrative, by connecting income distribution, demand and productivity. We argue that increasing income inequality led to lower aggregate demand and productivity. Stagnation is not secular but human-made and measures can be taken to combat it. Chapter I is dedicated to Verdoorn’s law – the link between output growth and productivity growth. While the overwhelming majority of empirical studies finds statistically significant and positive results for Verdoorn’s law, there is no consensus about its magnitude. Using meta regression analysis (MRA) on 52 studies with 665 estimations of Verdoorn’s law, we find no publication bias and statistically significant meta-averages for Verdoorn’s law in all specifications used by Verdoorn (1949), Kaldor (1975), and Rowthorn (1975). Apart from Rowthorn’s first specification, all used specifications yield Verdoorn coefficients between 0.44 and 0.69 which indicate increasing returns to scale.

Chapter II estimates Verdoorn’s law and the Marx-Webb effect based on data for 23 EU28 members for the period 1995-2017 using the EU-KLEMS data set (Stehrer et al. 2019). As EU-KLEMS separates by sector, the panel data analysis can differentiate between manufacturing and non-manufacturing sectors. Our contribution to the existing literature consists in 1) the use of auto-regressive distributed lag (ARDL) models, in order to separate between short-run Okun effects and long-run Verdoorn effects. Another contribution lies in the fact that, contrary to most of the available literature on Verdoorn’s law and the Marx-Webb effect, the analysis undertaken controls for potential cross-sectional dependence. Again, our analysis finds statistically significant Verdoorn coefficients – between 0.378 and 0.966 – and statistically significant Marx-Webb effects – between 0.193 and 0.315.

Chapter III again uses meta-regression analysis to provide an overview of the literature on the Bhadhuri-Marglin model. Most industrial countries have experienced a long-term fall in the wage share since the 1970s. Thus, there has been a shift in the functional distribution from wages to profits with consequences for economic growth. The overall strength of the approach consists in presenting a compromise between the neo-Kaleckian and neo-Goodwinian views of how changes in income distribution affect economic growth. The estimation results can thus be directly used for policy recommendations and are thus (at least amongst heterodoxy) subject to great debates. Two problems arise out of this. First, there is a strong split between wage-led and profit-led country results which are assumed to be partly explained by differences in estimation methodology. Therefore, there exists a need for a definitive answer how strongly these differences affect the overall outcome. This meta-regression analysis assesses 34 studies with 494 empirical estimates for domestic and total demand. Here, the MRA finds indications of small-magnitude publication bias in favour of wage-led demand regimes. More precisely, the average country is found to be wage-led when analysing domestic demand and profit-led in the case of total demand.

Keywords: wages, productivity, wage-led, profit-led, verdoorn’s law, meta-regression analysis, marx-webb effect

~~Centre d’Économie de Paris Nord (UMR CNRS 7234 CEPN)~~

– – – – –

Résumé

Depuis la crise financière mondiale de 2007, le débat économique dominant s'articule autour de la possibilité d'une "stagnation séculaire", c'est-à-dire une période prolongée de croissance nulle ou très faible du PIB. Les partisans de la stagnation séculaire trouvent généralement des explications possibles dans l'imperfection des marchés des capitaux, les changements démographiques et les innovations qui économisent le capital plutôt que de l'utiliser.

L'objectif de cette thèse de doctorat est de présenter une alternative au récit de la stagnation séculaire, en reliant la distribution des revenus, la demande et la productivité. Nous soutenons qu'inégalité croissante des revenus entraîne une baisse de demande globale et la productivité. La stagnation n'est pas séculaire mais d'origine humaine et des mesures peuvent être prises pour la combattre. Le chapitre I est consacré à la loi de Verdoorn – le lien entre la croissance de la production et la croissance de la productivité. Si l'écrasante majorité des études empiriques semble trouver des résultats statistiquement significatifs et positifs pour la loi de Verdoorn, il n'y a pas de consensus à propos de son ampleur. En utilisant une méta-analyse (MRA) sur 52 études avec 665 estimations de la loi de Verdoorn, nous ne trouvons aucun biais de publication et des méta-moyennes statistiquement significatives pour la loi de Verdoorn dans toutes les spécifications utilisées par VERDOORN (1949), KALDOR (1975) et ROWTHORN (1975). Hormis la première spécification de Rowthorn, toutes les spécifications utilisées donnent des coefficients de Verdoorn compris entre 0,44 et 0,69 qui indiquent des rendements d'échelle croissants.

Le chapitre II estime la loi de Verdoorn et l'effet Marx-Webb sur la base des données de 23 membres de l'UE28 pour la période 1995-2017 en utilisant l'ensemble de données EU-KLEMS (STEHNER et al. 2019). Comme EU-KLEMS permet l'analyse par secteur, l'analyse des données de panel peut différencier les secteurs manufacturiers et non manufacturiers. Notre contribution à la littérature existante consiste en 1) l'utilisation de modèles ARDL (auto-régressive distributed lag), afin de séparer les effets Okun à court terme des effets Verdoorn à long terme. Une autre contribution réside dans le fait que, contrairement à la plupart de la littérature disponible sur la loi de Verdoorn et l'effet Marx-Webb, l'analyse entreprise contrôle la dépendance transversale potentielle. Encore une fois, notre analyse trouve des coefficients de Verdoorn statistiquement significatifs – entre 0,38 et 0,97 – et des effets Marx-Webb statistiquement significatifs – entre 0,19 et 0,32.

Le chapitre III utilise à nouveau la méta-régression pour donner un aperçu de la littérature sur le modèle de Bhadhuri-Marglin. La plupart des pays industriels ont connu une baisse de la part des salaires depuis les années 1970. Il y a donc eu une déformation du partage de la valeur ajoutée en faveur des profits, avec des conséquences sur la croissance économique. L'originalité de notre approche consiste à présenter un compromis entre les points de vue néo-Kaleckien et néo-Goodwinien sur la façon dont les changements dans la distribution des revenus affectent la croissance économique. Les résultats de l'estimation peuvent donc être directement utilisés pour des recommandations politiques et sont donc sujets de grands débats. Deux problèmes en découlent (au moins parmi les hétérodoxes). Tout d'abord, il existe un fort clivage entre les résultats des pays tirés par les salaires et ceux des pays tirés par les bénéfices, qui s'expliquerait en partie par des différences dans la méthodologie d'estimation. Il est donc nécessaire d'apporter une réponse tranchée à la question de la mesure dans laquelle ces différences affectent le résultat global. Cette analyse de méta-régression évalue 34 études avec 494 estimations empiriques pour la demande intérieure et totale. Ici, la méta-régression trouve des indications d'un biais de publication de faible ampleur en faveur des régimes de demande tirés par les salaires. Plus précisément, on constate que le pays moyen est wage-led lorsqu'on analyse la demande intérieure et profit-led dans le cas de la demande totale.

Mots clés : salaires, productivité, wage-led, profit-led, loi de verdoorn, analyse méta-régression, effet marx-webb

Acknowledgements

The preparation of this doctoral thesis has been my constant companion for the last six years. No other project in my life has accompanied me so long and so intensively through all possible (and impossible) life circumstances. In these six years, there was not a day when I did not think about the dissertation. Not an evening off without it in my head. No weekend in innocent intellectual freedom. At the same time, I remember an immense number of beautiful and memorable moments. To me, it was the special combination of a multitude in economic theories and people from all over the world present at the CEPN that made working at this department unique. Beyond the participation in the daily life of a university institute, there is of course the city of Paris and all that it implies. Settling in, discovering and experiencing a major European city, with all its facets. After all these experiences, I have reached a point where there is nothing left to write except my acknowledgments. I write these lines about finishing my PhD with pride and joy, but also with melancholy. I suppose our Facebook profile would say 'it's complicated'. The burden that will soon fall from my shoulders will leave a void that will yet have to be filled.

Without wishing to diminish my own achievement, the truth is that I have an intact infrastructure of people and institutions at my disposal, without which it would probably not have come to this moment. In the following lines, I would like to express my gratitude to them for their support.

From childhood on, I grew up in an environment of strong and independent women. I would like to thank my mother Eveline List and Rosa Olmo Blas in particular for providing me with everything that one could wish for from his family.

In terms of my academic career so far, there are some people and groups that have had a particularly strong influence on me. Karl Milford is responsible for the few hours in my bachelor's degree that were not consisting neoclassical teaching, as well as for the – only ever-existing – units on philosophy of science. All economists would benefit from the latter. During my Master's studies, Engelbert Stockhammer in particular was groundbreaking for my further educational path. His thoughtful and clear comments were essential in digesting the literature. I still find myself using his formulations in my own lectures. I would like to thank my co-authors Quirin Dammerer, Miriam Rehm and Matthias Schnetzer for their cooperation in our joint project so far. Chapter III of this

thesis is based on our joint efforts. I am indebted to Michael Berger, Louison Cahen-Fourot, Quirin Dammerer and Thibaut Lenormant for the many hours of discussion, as well as the multiple proofreading of large parts of my thesis. Any PhD student can only count himself lucky to have such friends. Last but not least, I would like to thank Dany Lang for becoming my supervisor and for bringing Verdoorn's law to my attention as a possible topic of research.

Furthermore, there are a number of groups and institutions that should be mentioned here. First of all, there is the study group 'Roter Börsenkrach', which made the economics bachelor's degree at the University of Vienna bearable and filled it with life. In particular, our self-organised courses and the critical examination of the economic mainstream had a strong influence on my further studies. The 'International Student Initiative for Pluralism in Economics (ISIPE)' should also be mentioned here, as well as the 'Society for Plural Economics in Vienna'. In both groups, I got to know people who are fighting all over the world for a broad, realistic and naturally political way of teaching economics. The Erasmus Mundus Master's programme 'Economic Policies in the Age of Globalisation' (EPOG) started at exactly the right time when I was looking for an alternative to the generic neoclassical master programs in Vienna. It is no understatement to say that the last eight years would have been very different without EPOG. Here, I must also thank the Austrian Chamber of Labour, which supported me financially with a scholarship during this time. During my first years in Paris, I lived in a studio in the Cité Internationale Universitaire, of which I particularly appreciated the cultural offerings. Furthermore, I thank university administration, most of all Corinne Gauthier, for their efforts and repeated explanations of how this university works. Finally, I was able to pay for my living with the help of a 'contrat doctorale' from Sorbonne Paris Cité – something I am most thankful for.

During the past 6 years, I have taught more than 10 university courses. I am convinced that it is teaching that enables economists to break down complex relationships to simple explanations everybody can relate to. It is also teaching that ensures an exchange with the real world outside of the ivory tower that university research can become sometimes (at least with the real world of those privileged people to whom studying at a university is an option). With this in mind, I want to express my sincere thanks to my former and current students at Sorbonne Paris Nord (formerly Paris 13), Vienna University of Economics and Business and the University of Applied Arts Vienna.

During my doctoral studies, I came to appreciate many of my fellow students. Alexis, for example, with whom I unfortunately never got to spend enough time to build a true friendship. Ana Carolina, whose memeing-skills are second to none. Or Federico, whose friendly rivalry with Louison was always a source of amusement ('he still has to cut the spaghetti with a knife!!'). Hector, with whom I'm definitely going to visit the next Ska-P concert (va venir amor, va venir). Jeff, whose cropped hair I still feel

sorry for and who was the first to discover the Irishman in me. Joao, who, along with Rudy, has developed an unhealthy fondness for a peculiar sort of trains and who is second only to Ana Carolina in terms of memeing. Joel, whose mood is always bad when boca loses to river. Nicolas, with whom I share a great fondness for pastis, but whom I can never come close to in this respect. (On the other hand, we share a great love of economic history: with whom else can one discuss financial speculation on the buying and selling of titles of nobility in fourteenth-century France?) Rudy, who lives only on fast food and books. Salam, whom we will definitely hear from in the future. Serge, who is an even bigger dreamer than me. Yasmin, with whom I have never gone to dance forró (But I definitely will next time!).

The only thing left for me to do is to thank some of the people who have accompanied me in my life over the last few years and often far longer, who have shaped me in some way and whom will always have a special place in my heart. First, there are Bianca and Julia with whom I have the honor to share an inseparable friendship for most of my life. Bianca, who had always been there for me. And Julia, who only got celeriac from me, despite all the flowers of the world she deserves. Then there is Sergio, who is living proof that friendship transcends all borders of time and space. Gideon, Evelyn and Magnus, whose cup I will finally use with much pride after the successful PhD defence. Léo (affectionately called 'gros nez'), with whom I explored Belleville and the hospital there on multiple occasions. The same Léo who introduced me to the great moments of French cinema with 'OSS 117'. Louison, who at some point wants to have Frida Kahlo's love letters set to music by Aya Nakamura and who should never leave Vienna for another city. Marcela, who somehow manages to reconcile the doctorate and political activism after all – and who now finally has her jacket again. Marija, with whom everything is as beautiful as it used to be, despite years of not seeing each other. Monica, whom I wish the best wherever she is now. Milena, who together with Stephanie forms the sweetest cluster in all of Vienna. Olivia, who introduced me to the genuine great moments of French film with 'Jules et Jim' (and because of whom I love listening to Barbara). Paulus, whose big heart and enthusiasm for cross-cutting issues keeps us slipping into fascinating conversations (more of that, please, now that the PhD is over. Well, mine at least...). Mis Parcer@s de la muerte, who changed the way I look at IBIS hotels for the rest of my life. Quirin, to whom I was able to pass on the joy of pastis and with whom I will share it for many more evenings in my life. Riton, through whom I learned all the chansons from the time of the Paris Commune at the 'Vieux Belleville'. Resi, who would do anything for her friends. Simona, whose pullover I still wear and which makes me think of her. Stephanie, who lets my joy win against my fear of graduating soon. Thesi, who always feels like dancing at any time of the day. Thibaut, probably the best dressed man in Vienna. Vera, who can obviously read minds – but that's no big deal, because you can only think the very best about her. Noémi, who got into editing at an unexpectedly early age. Vicky, whose smile

alone makes the world a better place. Victor and Marianne, who bring Mexico a little closer to me every time we meet. Victor, the great artist, and Marianne, who possesses a heart as big as no one else. Victoria, whom I only really got to know in Paris and can't see nearly often enough back in Vienna. And Wilfried, with whom I have been united in friendship throughout my studies. I would also like to thank my long-time friends chanson française, red wine, salsa, chocolate and Viennese 'Schrammeln'.

Acronyms

AIC Akaike Information Criterion.

AMECO Annual macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs.

ARDL Auto-regressive distributed lag model.

CES Constant elasticity of substitution production function.

CS-ARDL Cross-sectional auto-regressive distributed lag model.

DCCE Dynamic common correlated effects model.

EU28 The 28 member countries of the European Union (prior to Brexit).

FAT Funnel-asymmetry test.

GDP Gross domestic product.

IMF International Monetary Fund.

MAER Meta-Analysis of Economics Research Network.

MMT Modern modern monetary theory, a sub-group within post-Keynesian economics which is especially prevalent in the US.

MRA Meta-regression analysis.

OECD Organisation for Economic Co-operation and Development.

PEESE Precision-effect estimate with standard error.

PET Precision effect test.

TFP Total factor productivity – the portion of growth in output not explained by a traditional Cobb-Douglas production function.

US United States of America.

WLS Weighted-least-squares.

Symbols

α output elasticity of capital (assuming a Cobb-Douglas production function)

β output elasticity of labour (assuming a Cobb-Douglas production function)

c_{Π} propensity to consume out of profits s_W

c_W propensity to consume out of wages

\dot{e} employment growth

η elasticity of labour supply with respect to the real wage (assuming a Cobb-Douglas production function)

g_n 'natural' growth rate

I aggregate private investment

$\frac{I}{Y}$ investment-output ratio

K aggregate capital stock

$\frac{K}{Y}$ capital-output ratio

μ returns to scale

n number of observations

p precision (the inverse standard errors of the primary literature)

Π aggregate profits

π profit share (the relative share of total profits with respect to output, wage share and profit share together result in total GDP)

ψ wage share (the relative share of total wages with respect to output, wage share and profit share together result in total GDP)

-
- \dot{q} output/demand growth
- r partial correlation
- S aggregate private savings
- s_{Π} propensity to save out of profits s_W
- s_W propensity to save out of wages
- $\frac{S}{pY}$ saving-income ratio
- se standard error
- σ elasticity of substitution between labour and capital
- t t-statistics of the primary literature
- τ_1 demand regime (positive in wage-led demand regime, negative in profit-led demand regime)
- \dot{w} real wage growth
- ξ effect of demand-induced technical change (used by Basu and Budhiraja (2020))
- Y aggregate output/demand
- \dot{y} productivity growth
- \dot{y}_q Verdoorn effect (effect of output growth on productivity growth)
- \dot{y}_w Marx-Webb effect (effect of real wage growth on productivity growth)

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1 Introduction

2 One of the central advantages of Capitalism with regard to former systems of economic
3 and political order is its dynamism, reflected in positive productivity growth rates.
4 As can be seen in Figure 1, before the industrial revolutions, we lived in a world of
5 permanent economic stagnation. This state of living was called the '*cycle of misery*' by
6 political economist Thomas Malthus – better known today as the '*Malthusian trap*'.
7 Productivity growth rates were close to zero before the 18th century and therefore,
8 gross domestic product (GDP) could only increase due to an increase in population.
9 GDP per capita, however, stayed constant and humanity was doomed to live in a
10 world without much of an increase in living conditions. It was only with increases
11 in productivity, starting with the first industrial revolution, lead by the use of fossil
12 fuels, slave economies in colonial regions and higher wages (Allen 2011) - that GDP
13 per capita experienced an extreme rise. The achievements obtained by the industrial
14 revolution started in Western European countries and then diffused across the globe -
15 that is, of course, without taking into account the increase in income inequality which
16 accompanied the emergence of capitalism (Piketty 2020).

17 One of the questions arising out of this is whether these increases in productivity
18 can be sustained in '*mature capitalism*' just as well as during its '*infant stage*'. My
19 bachelor in Economics at the University of Vienna started back in 2009, in midst of the

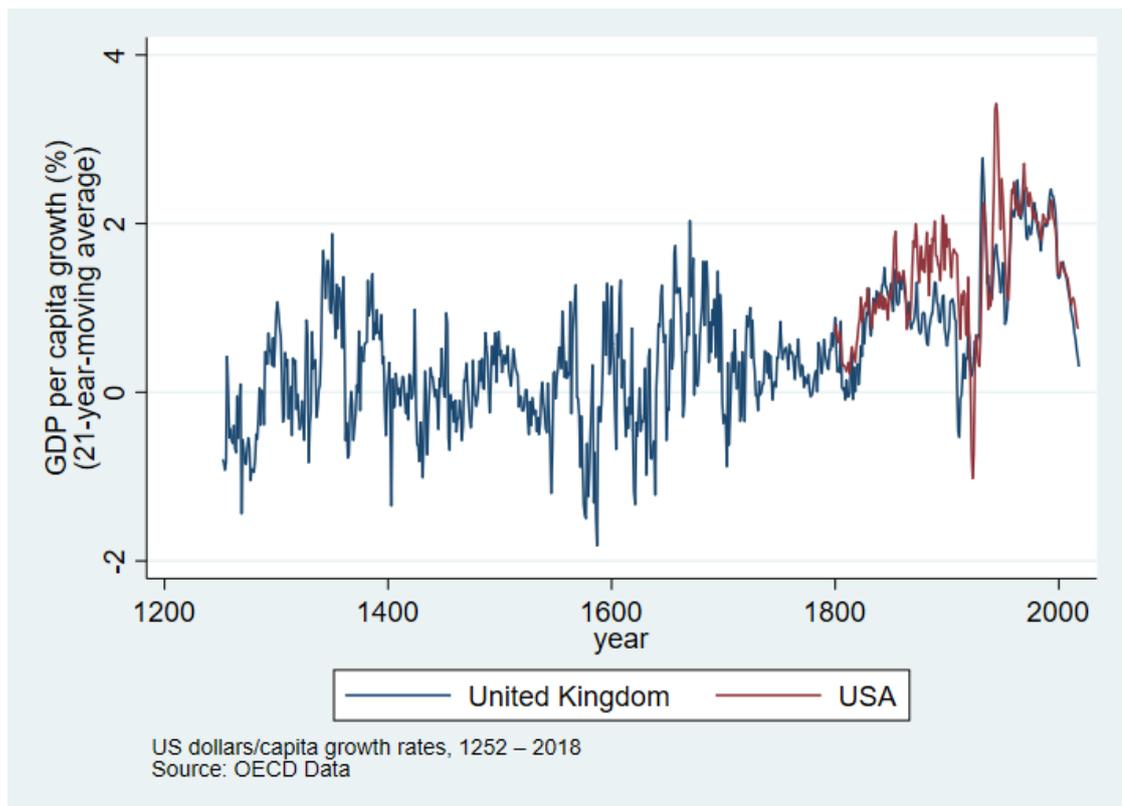


Figure 1 – GDP per capita growth rates 1252-2018 using 21-year moving averages

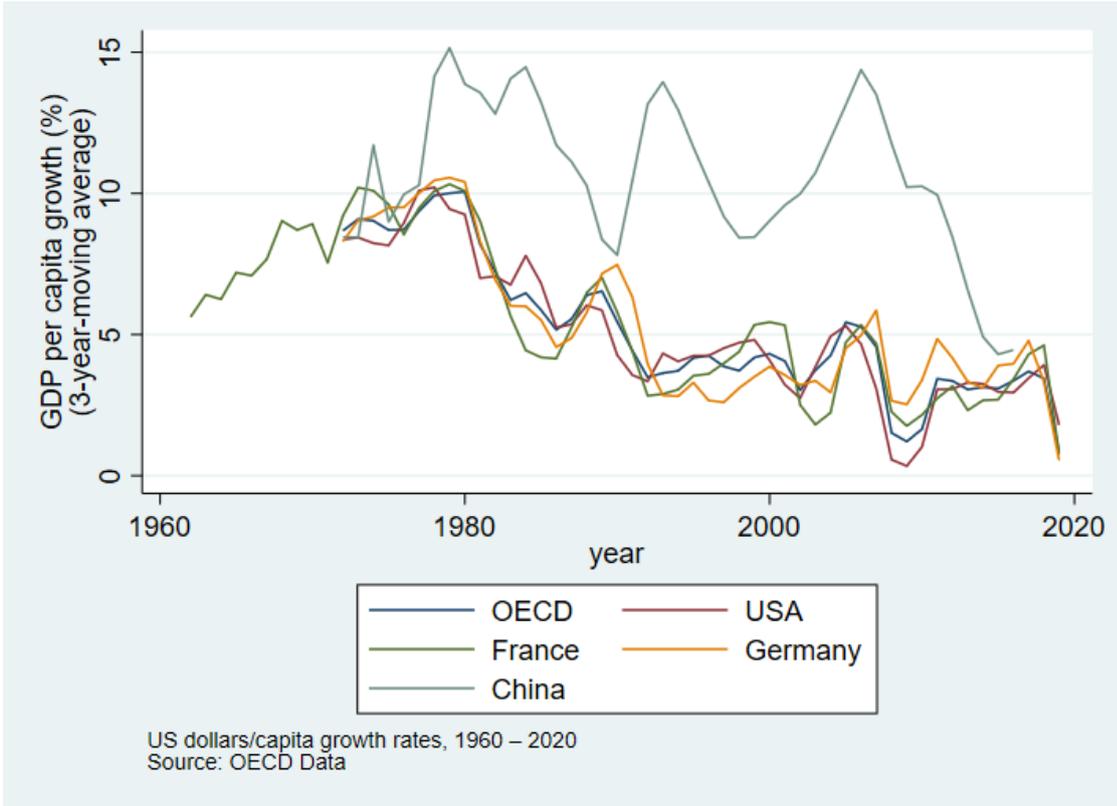


Figure 2 – GDP per capita growth rates 1960-2020 using 3-year moving averages

20 shock waves of the Global Financial Crisis and the Great Recession. Both events marked
21 yet another decline in the long-run development of world-wide growth which already
22 started during the 20th century. Indeed, this trend of falling growth rates had already
23 started from the last quarter of the 20th century onward, as can be seen in Figure 1. In
24 the past years, GDP per capita growth rates for both the United Kingdom and the United
25 States (US) have reached levels lastly seen at the beginning of the 20th century. Since
26 the Global Financial Crisis, many countries have not been able to return to pre-crisis
27 GDP growth rates. This is even more evident when comparing their growth experiences
28 to the post-war period. As can be seen in figure 2, the GDP per capita growth rates for
29 Germany, China, the US and members of the Organisation for Economic Co-operation
30 and Development (OECD) in general have been continually falling from the 1980s
31 onward. Even China, although not following the overall trend, finds itself confronted
32 with the lowest recorded growth rates in its history.

33 For some mainstream economists, these stylised facts represent not just a short-run
34 deviation from the respective countries' long-run growth path. Rather, the growth path
35 itself changed. Low growth rates are not signs of the economic cycle's longer downturn.
36 Instead, according to certain economists, low growth has come to stay (Summers 2014b;
37 Gordon 2015). As is often the case with grand ideas in economics, both good and bad,
38 this idea is not novel but rather a rehash of an 'academic scribbler of a few decades back'
39 (Keynes 1936). The idea of 'secular stagnation', a grim future, paved with sustained low
40 or no GDP growth rates was first expressed by Alvin Hansen back in the 1930s. Hansen
41 (1938) created this concept in midst of the Great Depression, the longest, deepest and
42 widest crisis in capitalism's history up to date (Kindleberger, DeLong, and Eichengreen
43 2013). In its current version, the possible explanations of such secular stagnation range
44 from a global 'savings glut', innovations becoming less innovative to demographic

45 changes.

46 In this thesis, we argue that the mainstream's attempt to explain low growth rates
47 during the past decades is both unsuccessful and throwing out the baby with the
48 bathwater. Negative equilibrium interest rates, less innovative innovation or an ever-
49 ageing and -indebted population are overly complicated explanations and are put
50 forward for consistency within mainstream economics more than to point at the problem
51 at heart. Instead, we propose a different explanation for weak long-term growth
52 rates, building on 85 econometric studies on the determinants of demand growth and
53 productivity growth. Furthermore, we conduct a panel data analysis of our own using
54 data for 23 of the (former) EU28 member states. As we will argue, there is nothing
55 secular about this stagnation. Following well-known heterodox literature, the Verdoorn
56 effect (Verdoorn 1949; Kaldor 1966; McCombie, Pugno, and Soro 2002) might be a much
57 better explanation for long-term low growth rates. Our counter-proposal lies in taking
58 demand effects seriously, even in the long run. According to this view, the long-run
59 increase in personal and functional income inequality on the national scale has resulted
60 in relatively lower aggregate income and thus lower aggregate demand. This decrease
61 in demand not only leads to lower growth rates today, but via Verdoorn's law results in
62 lower productivity growth rates. Stagnation is thus not secular - it is human-made and
63 appropriate measures can in consequence be taken against it.

64 Using 'Verdoorn's law' – the relation between aggregate demand growth and pro-
65 ductivity growth – to explain today's low GDP growth via higher income inequality
66 presupposes an economic effect from inequality to GDP growth. While in mainstream
67 economics, this topic has been completely out of the centre of attention, interactions
68 between the functional distribution of income and GDP growth have been a core
69 issue for several schools of economic thought for a long time. In particular, the post-

70 Keynesian and neo-Goodwinian literature have focused on this relationship for decades.
71 The Bhadhuri-Marglin model (Bhaduri and Marglin 1990, also known as the 'wage-
72 led/profit-led model') has been commonly used for the past 30 years to analyse changes
73 in functional income distribution and GDP growth.

74 In continuation, section 1 presents an overview of the theoretical debate on secular
75 stagnation in the mainstream and its critique. Section 1 then presents the alternative
76 framework we use in the remainder of this thesis.

77 **Secular stagnation - the theoretical debate**

78 The debate about secular stagnation is older than is commonly assumed. While the term
79 'secular stagnation' today is broadly associated with New Keynesian economist Larry
80 Summers, it tracks back to the 1930s and was first used by Alvin Hansen. Figure 4a
81 shows a Google Ngram plot of the word 'secular stagnation' in four different ways of
82 spelling. Google Ngram is an online search engine that charts the frequencies of any
83 given set of words using digitalised sources of Google's text archive. If the given word
84 or word combination is found in 40 or more books the yearly frequency relative to the
85 overall text archive is displayed as a graph.

86 Hansen's (1938) worries were heavily discussed until the mid-1950s amongst
87 economic theoreticians, most notably Joseph Schumpeter and Paul Sweezy (Roubtsova
88 2016). This intermezzo is of particular interest to our thesis, as the arguments put
89 forward by Sweezy were reformulated into a seminal book on the US economy by
90 Baran (1966). This book contained arguments that would be used in both the debates
91 surrounding secular stagnation and the debates on income distribution and growth
92 that would later on emerge as the Bhadhuri-Marglin model (Lavoie 2017a, p. 202). The

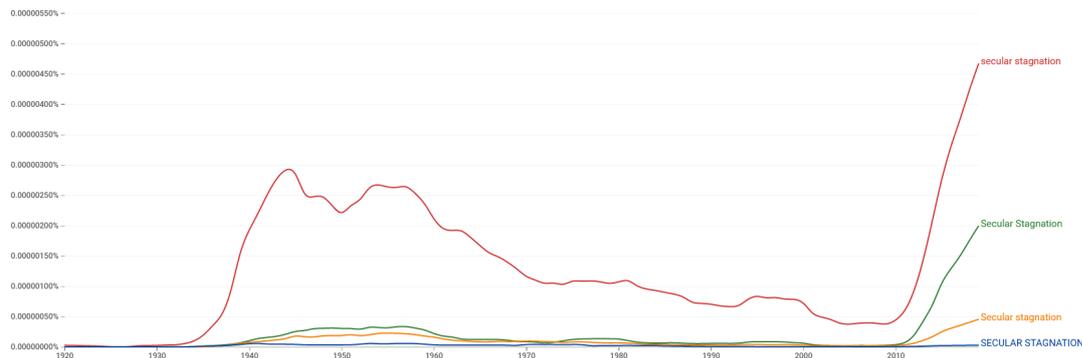


Figure 3 – Google Ngram of 'secular stagnation'

(a) The values on the y-axis represent the relative share the word 'secular stagnation' relative to all words in Google corpus as a percentage.

93 mainstream debate on secular stagnation has the same roots as the heterodox debates
 94 on demand, productivity and employment regimes. Nevertheless, the debate inside the
 95 economic mainstream only started again after the influential contributions of Summers
 96 (2014a) and Summers (2014b).

97 Summers argued that Hansen's (1938) theory of secular stagnation might explain the
 98 current weak growth performance of the United States. According to Summers (2014a),
 99 the US growth experience from the 1990s onward has been weaker than before and only
 100 sustained by ever-increasing financial bubbles. Economic growth has not been stable
 101 and indeed built upon an unsustainable base of ever-rising prices of financial assets
 102 for the past 20 years, combined with rising private debt. Therefore, the US economy,
 103 according to Summers (2014a), has been structurally stagnant due to a lack of aggregate
 104 demand, even in the long run. This had led to a negative natural rate of interest (the
 105 interest rate that guarantees full employment in the Wicksellian sense), against which
 106 central banks could not intervene with sufficient strength due to the 'zero lower bound'.

107 The zero lower bound expresses the fact that the nominal interest rate set by
 108 central banks cannot go below zero. According to mainstream economic theory, central

109 banks conduct monetary policy via interest-rate targeting in such a way that aggregate
110 supply of 'loanable funds' (savings) equals its demand (investments). In this case of
111 excessively high savings and/or excessively low investments, Summers (2014a) explains,
112 the resulting equilibrium interest rate can turn negative. In this case, central banks
113 could try to increase investments via expansionary monetary policy in form of lower
114 interest rates. Under the extreme circumstances described by Summers (2014a) however,
115 central banks find themselves unable to accommodate this excess supply in loanable
116 funds. Instead, central banks find themselves 'running out of ammunition' at the lower
117 bound of zero percent interest rates.

118 In normal times this excess in savings would lead to a capital outflow into the rest
119 of the world because rentiers would be looking for higher financial profits elsewhere.
120 Contrary to the prediction of mainstream theory however, this equilibrating outflow
121 of domestic financial flows did not happen. The result is a reinforcement of already
122 existing global current account imbalances between excess-saving current account
123 surplus countries and indebted current account deficit countries¹. Since the financial
124 outflows needed for full employment did not happen, Summers (2014a) concludes that
125 secular stagnation might affect not only the US economy, but rather the world as a
126 whole.

127 The main reason brought forward for such a 'global savings glut' is the ageing
128 populations of important parts of our world. This issue becomes especially important in

¹While these current account imbalances according to mainstream economics textbooks should not exist, the real-world imbalances are of significant magnitude. Both current account surpluses as well as current account deficits are unsustainable in the long run. A country running a current account deficit is accumulating debt against the rest of the world. If the respective country has to indebt itself in a currency over which it has no sovereignty over (i.e. which it can create itself), a continued current account deficit leads to a country's bankruptcy. While one country's current account surplus represents higher financial independence, its' excess savings represent forgone investments that could have improved living standards. More importantly, a growth strategy based on current account surpluses is unstable in the long run, as it relies on the falling demand of ever-higher indebted current account deficit countries.

129 countries with not adequately developed pension systems like China, India and Japan
130 where people need to allocate adequate savings for future retirement.

131 A fall in relative prices of global investment goods might further reinforce global
132 imbalances. The Great Depression of 2007-2008 itself created significant uncertainty
133 about the stability of the global financial system, triggering a rise in the demand of
134 safer assets. At the same time, the increase in public debt due to necessary government
135 spending in form of financial aids during the Great Recession and its aftermath is put
136 forward as another reason for insecurity on global financial markets. This idea is what
137 Paul Krugman calls the 'confidence fairy'. According to this view within mainstream
138 economics, a cut in government expenses would project a long-term strategy to lower
139 public debt and avoid bankruptcy. As these measures would restore confidence about
140 a country's public debt development in global financial markets, interest yields on
141 government bonds would fall. Yet, the mainstream policy recommendations of 'balanced
142 budgets', based on zero-deficit spending are precisely what the amount of safe assets
143 that governments around the world could provide for finance, desperately looking for
144 secure profits. The global savings glut, in consequence, embodies nothing else but the
145 flip-side of the 'balanced budget' dogma that governments all over the world subjected
146 themselves to.

147 A third potential reason for low growth in the secular stagnation literature is the
148 debt overhang in many parts of the world. Prominent examples consist in high student
149 debts, especially in Anglo-Saxon countries. Another example is the world-wide rise of
150 indebtedness of firms since the Great Recession which was perceived by economists
151 with increasing discomfort. Here, different explanations are put forward. On the one
152 hand, the gigantic expansionary monetary policies put forward by central banks in
153 the western world enabled firms to preserve unsustainable business models for much

154 longer than usually possible. These fears of 'zombie firms' are especially prevalent
155 amongst European countries and have only increased following the repeated enforced
156 shutdowns of economic activity due to the repeated COVID-related lock-downs of
157 2020 and 2021. On the other hand, the reluctance of private banks to give out loans to
158 businesses and households because of doubts concerning credit-worthiness is seen as a
159 possible source of stifled demand.

160 Two final reasons possibly leading into an age of lower growth are being put forward.
161 One concerns the overall decrease in human capital, for example in form of workers'
162 average years of studies a topic especially discussed in the case of the US. The other
163 prominent idea is Hansen's (1938) argument that innovations became less innovative
164 over time.

165 In summary, the potential 'headwinds' (Gordon 2015) of demography, debt, educa-
166 tion, inequality, lacking innovation as well as passive private and public investment
167 demand are the main culprits put forward as possible causes for secular stagnation.
168 As was already argued in chapter I, the debate around secular stagnation might have
169 triggered renewed interest in Verdoorn's law, the relation between output/demand
170 growth on productivity growth.

171 In 'The New Normal: Demand, Secular Stagnation, and the Vanishing Middle class',
172 Storm (2017) argues that the current debate on secular stagnation is an artificial question.
173 Rather than exogenous shocks or supply constraints it really is depressed demand that
174 permanently lowered productivity growth, the engine of long-term economic growth.

175 After devoting a considerable part of his article to criticising the concept of both total
176 factor productivity (TFP) as well as the use of any model based on a Cobb-Douglas-type
177 of production function, Storm (2017) argues that the secular stagnation of U.S. economic
178 growth and the vanishing of the American middle class actually do have common roots

179 – in the deliberate creation after 1980, through economic policies, of a structurally
180 low-wage-growth economy that not only polarised jobs, incomes, and wealth as well
181 as slowed down capital deepening, the division of labour, and labour-saving technical
182 progress in the dynamic segment of the economy.

183 Because labour productivity growth, in turn, is influenced by demand factors, the
184 causes of secular stagnation must lie in inadequate demand. Inadequate demand, in
185 turn, is the result of a growing segmentation of the U.S. economy into a 'dynamic'
186 group of sectors that is shedding jobs and a 'stagnant' or 'survivalist' group of sectors
187 that acts as an 'retention basin of employment' for those that cannot find jobs in the
188 dynamic sectors. Hence the outlook might be similar to Storm and Naastepad (2013):
189 Unemployment might be averted but the price to pay might be too high, namely in
190 form of low-quality employment, also known as 'Bullshit-Jobs' (Graeber 2018; Galbraith
191 2017). '*Hence, sluggish business investment in the United States has been a key factor*
192 *behind the stagnation of TFP growth as well as responsible for propagating hysteresis-like*
193 *adverse consequences for TFP and potential output after 2008*' (Storm 2017, p. 182). The
194 argument is illustrated with long-run growth-accounting data for the U.S. economy
195 (1948–2015). The mechanics of dualist growth are highlighted using a Baumol-inspired
196 model of unbalanced growth. Using this model, it is shown that the 'output gap', the
197 anchor of monetary policy, is itself a moving target. As long as this endogeneity of
198 the policy target remains not understood, monetary policy makers will continue to
199 contribute to unbalanced growth and premature stagnation.

200 Storm (2017) makes a powerful argument from a post-Keynesian perspective, stating
201 the importance of demand-side effects not only in the short, but in the long run as well.
202 Rather than some mysterious external forces condemning the US to everlasting low
203 growth it might very well be that some internal mechanism led to this outcome. Storm

204 (2017) stresses the importance of income distribution and its link to innovation via the
205 Kaldor-Verdoorn effect from a macro-economic point of view.

206 However, several question could be asked to be discussed in greater detail. First,
207 why is there no discussion of financialisation? Given the overall timeline covered by
208 the author, one would expect to at least have a short mentioning of the most important
209 contributions highlighting the fundamental changes that the financial system went
210 through during the last sixty years, thereby changing the options of states, capitalists
211 and workers as well. There might indeed be reason to think that the Kaldor-Verdoorn
212 effect itself might have gotten weaker during financialisation. Secondly, the effect of
213 off-shoring, the 'platform-capitalism' and crowd-working might explain some part in
214 the overall process of de-industrialisation reported by Storm (2017). Jobs like cleaning,
215 which in national account standards count towards manufacturing might change their
216 position to the service sector when the cleaning personal in question is starting to work
217 for an external firm. This might mean that the overall effect of de-industrialisation is
218 being over-estimated.

219 While Galbraith (2017) shares Storm's (2017) dismissal of TFP growth as an ex-
220 ogenous determinant, there are more disagreements than points in common when it
221 comes to questions of methodology as well as the political and economic implications
222 of inequality, wage repression and the role of demand for the poor performance of the
223 US in the last decade. Starting with a critique of Storm's (2017) use of equilibrium-based
224 modelling and the use of neo-classical modelling in order to convey a message across
225 schools of thought-borders, the author emphasises the need for Evolutionary Economics
226 as an alternative to continuing equilibrium-based demand-centered modelling. Accord-
227 ing to the author in using this kind of paradigm, 'the conceptual distinction between
228 demand-side and supply-side effect fades away' (Galbraith 2017, p. 212). According to

229 the author, this creates a complete misunderstanding of the underlying problems. 'The
230 *distinction between equilibrium and evolution affects the policy menu directly. For those*
231 *who favour the hysteresis view, the solution appears to be steady pressure on the demand*
232 *front [...] In the evolutionary view, the engine is broken and may or may not be possible*
233 *to repair.'* (ibid.). There is also severe disagreement on the overall social conditions of
234 the US-American middle class. While Storm (2017) perceives its' vanishing, Galbraith
235 (2017) cannot see any proof for this, stating that although under attack, the social pillars
236 of the American middle-class still prevail. He also criticises Storm's (2017) use of the
237 median wage as an indicator for the middle-classes' well-being while doubting the
238 usefulness of presenting each economic sector on its own rather than stressing the
239 connectivity of certain industrial and service-sectors (using the car industry and car
240 retailers as an example). Agreeing with the author of the original paper, Galbraith (2017)
241 claims the experience of Sweden to be a prime example of wage-led innovation policy,
242 stressing that '*labor market deregulation, depressing wages, discourages productivity*
243 *growth'* (Galbraith 2017, p.214).

244 Galbraith's (2017) comment is certainly valuable in that he adds another layer
245 questioning Storm's (2017) methodology, especially when it comes to his neglect of
246 sectorial interdependencies. Several other remarks made seem to be surprising however.
247 It seems hard to imagine that following the recent events in US politics the author
248 really cannot see in what kind of way the US middle-class should be declining, or at
249 least feel as if it was declining. On more economic terms, it seems inconsistent to
250 mention Sweden as an argument for the use of high-wage policies for long-term growth
251 and at the same time arguing that this relationship changes once 'countries get rich'
252 (as if that were a static term) and that '*the employment of large numbers at modest*
253 *wages [...] would have to be afforded and tolerated by the population that pays for them'*

254 just one paragraph later. Similarly one phrase later, Galbraith (2017) comments that
255 higher wages in education or health-care would increase productivity, as both are very
256 labour-dependent. While this might be true in the middle term, there would be no cars
257 if everybody had agreed on the notion that 'all we need is a faster horse'.

258 Contrary to Galbraith (2017), Lazonick (2017) agrees with Storm (2017) about the
259 general decline of the US middle-class as well as the ever-increasing income inequality.
260 While overall agreeing with Storm (2017), the author provides a micro-economic expla-
261 nation of the effect of financialisation of the firm, away from 'refrain and re-invest' to
262 'downsize and distribute' that is quite in harmony with the macro-economic explana-
263 tion provided by Storm (2017). The major difference is that Lazonick (2017) sees most
264 of the processes mentioned by Storm (2017) as supply-side, rather than demand-side
265 effects. Altogether, three forces of change are being identified, namely rationalisa-
266 tion (characterised by plant closings and permanent layoffs, terminating the jobs of
267 high-school-educated blue-collar workers, many of them well-paid union members),
268 marketisation (characterised by the explicit eradication of a career with one company
269 as an employment norm) and globalisation (characterised by an acceleration of the
270 movement of employment offshore to lower-wage nations and the movement to the
271 United States of foreign workers). In the words of the author,

272 *'U.S. corporations often pursued rationalisation, marketisation, and global-*
273 *isation to cut current costs rather than to re-position themselves to produce*
274 *competitive products [while at the same time] Trillions of dollars that could*
275 *have been spent on innovation and job creation in the U.S. economy over the*
276 *past three decades have instead been used to buy back stock for the purpose of*
277 *manipulating stock prices. For the decade 2007–2016, U.S. corporations' total*

278 *net equity issues—new share issues less shares taken off the market through*
279 *buybacks and merger and acquisition deals— averaged minus \$412 billion*
280 *per year. For 2007–2016, the 461 companies in the S&P 500 Index in January*
281 *2017 that were publicly listed over the decade expended \$4.0 trillion on stock*
282 *buybacks, representing 54.5%’ (Lazonick 2017, pp.221).*

283 To recapitulate, the secular stagnation-narrative is nothing new stems from the
284 seminal work of Hansen (1938). While Hansen (1938) argued in a (relatively) demand-
285 side fashion, the secular stagnation narrative today uses mainly supply-side arguments.
286 While these arguments are certainly important issues to take into account, they do
287 ignore crucial economic mechanics that are highlighter by authors such as Storm
288 (2017), Galbraith (2017), and Lazonick (2017). Contributions such as Gordon (2015) are
289 intriguing in that they lead us to think about deeper structural changes happening in
290 leading economies such as the US. They are however fatalist in nature and provide a
291 glimpse into a rather bleak future. We argue that the decline in GDP per capita growth
292 cannot be explained by imperfect capital markets or demographic changes alone. In
293 that regard, our argument is similar to the one put forward by Storm (2017), that is, the
294 changes in real wages and demand during the recent decades had long-run impacts on
295 productivity.

296 **The Distribution-Productivity-Employment Nexus - An** 297 **Alternative To The Secular Stagnation-Narrative**

298 Table 5 is based on Storm and Naastepad (2013) and represents the underlying reasoning
299 behind the effects of wages in the long run. The squared boxes represent macroeconomic

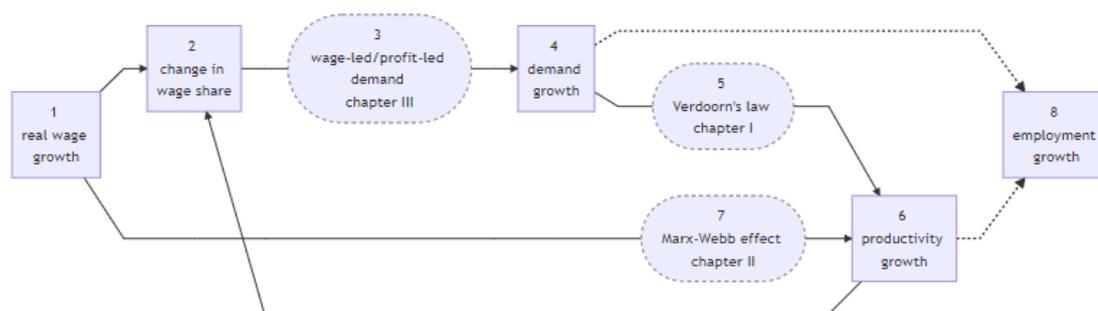


Figure 5 – The distribution-productivity-employment nexus, based on Storm and Naastepad (2013)

300 effects resulting from changes in other macroeconomic variables. These squared boxes
 301 are linked together via arrows, with round boxes in between in some cases. The round,
 302 dashed boxes represent the contributions provided by this thesis in chapters I to III
 303 concerning three macroeconomic relations: the respective nature of the demand regime
 304 (wage-led or profit-led), Verdoorn's law and the Marx-Webb effect. Only the lines with
 305 an arrow represent economic causalities. With these chapters, we intend to contribute
 306 to a heterodox explanation for low growth rates in the long run providing an alternative
 307 to the mainstream secular stagnation debate. The model is able to depict changes in
 308 demand regimes, productivity regimes and employment regimes. In this thesis, the
 309 focus shall lie on the demand and productivity regimes.

310 We start with a change in wages. This has two potential effects on productivity
 311 growth. First, a change in wages might lead to a change in the wage share. This,
 312 however, is subject to the relative growth of real wages and productivity. If real wages
 313 rise faster than productivity, the wage share increases. If real wages rise slower than
 314 productivity, the share of wages in the total economy decreases - even if total real
 315 wages increased.

316 Next, we are interested in the effect of the change of functional income distribution
317 on GDP growth. Here, the model proposed by Bhadhuri and Marglin (1990) provides
318 a flexible framework to represent two opposed macroeconomic effects of wages -
319 wages as a source of income and hence, private consumption; and wages as a source
320 of cost of production and hence, private investment. As both effects influence final
321 aggregate demand, the question arises which of the two effects dominates. If the
322 private consumption aspect dominates we speak of a 'wage-led demand-regime'. In the
323 case that the effect that real wages have on private investment dominates we speak of
324 a 'profit-led demand-regime.

325 The overall nature of the demand-regime will determine the effect that a change in
326 wages will have on aggregate demand. The change in aggregate demand will then affect
327 productivity growth via 'Verdoorn's law' - the effect that aggregate output/demand
328 growth has on productivity growth in the long run due to macroeconomic increasing
329 returns to scale.

330 The second mechanism via which real wages affect productivity growth is depicted
331 in the lower path of table 5. Here, higher real wages lead to an increase in the cost
332 of production. This increase in production costs incentivises capitalists to invest into
333 labour-saving technology, which ultimately increases productivity. This effect is know
334 as the wage-push effect.

335 We can immediately see that in this model, the productivity regime, and hence
336 productivity growth, will ultimately be determined by the combined effects of aggregate
337 demand (via Verdoorn's law) and the change in the costs of production (via the wage-
338 push effect). Both higher production costs and higher aggregate demand lead to higher
339 increases in productivity. The effect of an increase in real wages will always be increased
340 costs of production. We can therefore assume that an increase of real wages, via the

341 wage-push effect, will always lead to faster productivity growth. The effect of an
342 increase in real wages on productivity growth via Verdoorn's law, however, is unknown
343 as long as we cannot determine the underlying demand-regime. In the case of a wage-
344 led demand-regime, the private consumption effect dominates the investment effect and
345 thus, an increase in real wages will lead to higher aggregate demand. The increase in
346 aggregate demand then leads to an increase in productivity growth via Verdoorn's law.
347 In the case of a profit-led demand-regime, an increase in real wages leads to a stronger
348 reaction of private investment than of private consumption. Aggregate output will
349 therefore decline, which in consequence will lead to slower productivity growth due to
350 Verdoorn's law. Here, chapter III provides a meta-regression analysis of 34 empirical
351 studies on domestic and total demand regimes, finding that the average country has a
352 profit-led demand regime.

353 Combining both Verdoorn's law and the wage-push effect, we are faced with two
354 possibilities. First, we have a scenario of an economy with a wage-led demand-regime.
355 This 'favourable productivity scenario' leads to higher productivity growth via both
356 Verdoorn's law and the wage-push effect. Second, we have the 'conflictive productivity
357 scenario' with a profit-led demand-regime. Here, higher real wages lead to higher
358 productivity growth via the wage-push effect, but lower productivity growth via Ver-
359 doorn's law. The final effect of real wage growth on productivity growth then depends
360 on the relative strength of the two effects. Productivity growth, in turn, will determine
361 the overall wage share in the economy as described at the beginning.

362 There still remains the question of the employment regime. By definition, employ-
363 ment growth is the residual of demand growth and productivity growth (employment
364 growth = demand growth - productivity growth). This means that while even under a
365 wage-led demand regime productivity will certainly increase, this is not necessarily

366 the case for employment. Indeed, in many cases we might face a combination of rising
367 demand and productivity but falling employment. This highlights again the central-
368 ity of productivity growth in a capitalist economy, linking distribution, growth and
369 employment. A wage-led growth strategy, even in countries with a wage-led demand
370 regime, might not be enough to ensure rising living standards for all workers, as the
371 increase in wages and productivity might need to be paid by those workers who lose
372 their jobs do to higher productivity.

373 This finding however does not mean that rising unemployment is inevitable. Given
374 that the private market will not employ these workers, the only means to stabilise
375 employment growth is government policies that boost employment. One example might
376 be a dedicated campaign to create public jobs. These jobs are traditionally Keynesian in
377 nature, but are especially advocated amongst followers of 'Modern Monetary Theory'
378 (MMT) today. Another way to influence employment growth lies in a general decrease
379 in weekly working time, for example from 40 to weekly 30 hours as we had already
380 argued in List (2019).

381 The outline of the present thesis is as follows: In the remainder of this introduction,
382 we present the main concepts and debates surrounding the idea of secular stagnation
383 provide a post-Keynesian alternative to the secular stagnation-narrative. Chapter I adds
384 to the available literature by providing a more detailed summary of the idea behind
385 Verdoorn's law and the available theoretical and empirical literature related to this issue.
386 Furthermore, it elaborates and improves the available literature via a meta-regression
387 analysis of the available empirical literature on Verdoorn's law. Chapter II provides
388 estimates of the Marx-Webb effect which, analogous to the estimates of Verdoorn's
389 law, are found using panel data analysis of Verdoorn's law in 23 EU member countries
390 between 1996 and 2017 using the EU-KLEMS data set (Stehrer et al. 2019). The value

391 added here is that the EU-KLEMS data set provides us with data at the sectorial level,
392 thereby enabling us to estimate with a much higher number of observations. Also,
393 we are able to distinguish between the manufacturing sector, where Verdoorn's law is
394 supposed to be at work, and other non-manufacturing sectors. For the estimation of
395 both effects, we use a modified 'auto-regressive distributed lag' (ARDL) model provided
396 by Ditzen (2021), which takes into account both the distinction between Okun's law
397 and Verdoorn's law and potential cross-sectional dependence. Chapter III extends the
398 available literature on the Bhaduri/Marglin model, also known as the wage-led/profit-
399 led model, via the use of a meta-regression analysis. It describes the available empirical
400 literature on the wage-led/profit-led model as well as the differences in econometric
401 specifications and theoretical assumptions. It further pools the available demand-regime
402 estimates and checks for an underlying true effect, while also explaining the deviation
403 of the reported estimates from this underlying effect. Chapter IV summarises the
404 main findings and presents the value-added provided in this thesis, discusses policy
405 implications and presents potentials for further research.

406

Part I

407 **Uncovering the relationship between**

408 **output and productivity - A**

409 **meta-regression analysis of**

410 **Verdoorn's Law**

Chapter 1

A meta-regression analysis of Verdoorn's law

1.1 Introduction

In 1949, P.J. Verdoorn published an article pointing at a potential link between the long-run rate of growth of labour productivity and the rate of growth of output. Verdoorn's conclusion was that the causation runs from the rate of growth of output to productivity growth. Typically, this 'Verdoorn coefficient' is found to be positive and smaller than 1. This finding was first referred to by Arrow (1962) and later on was coined as 'Verdoorn's law' by Kaldor (1966).

Kaldor (1966) also used the findings of Verdoorn (1949) in order to explain the by then slow rate of growth of the UK economy – the reason for which Verdoorn's law is also known as 'Kaldor's second law'.¹

¹'Kaldor's first law' characterises a positive relationship between the growth rate of manufacturing output and aggregate output. The third law states a positive relation between productivity growth in the manufacturing sector and the non-manufacturing sector. This happens because based on the assumption of decreasing returns to scale in non-manufacturing - if resources are being moved out of the latter,

424 In summary, Verdoorn's law is important for four reasons. First, a positive Verdoorn
425 coefficient signifies that an increase in output growth creates an increase in productivity
426 growth. For demand-side economists, Verdoorn's law provides a link between aggregate
427 demand and long-run economic growth. Second, if Verdoorn's law exists, it implies a
428 learning curve. During the descent along the learning curve, more firms enter the market.
429 As demand for the product is not saturated yet, real wages can grow. We can thus enter
430 a phase of 'triple rents' for profits, wages and tax income. Third, since Verdoorn's law is
431 supposed to be smaller than 1, there will be some additional employment created (since
432 by definition employment growth is the residual of output growth and productivity
433 growth). Verdoorn's law is supposed to be valid in manufacturing only. Manufacturing
434 therefore becomes the 'engine of growth' and structural change, as more and more
435 employment from other sectors gets absorbed. Finally, such a 'well-behaved' Verdoorn
436 coefficient implies increasing returns to scale, which themselves imply ever-improving
437 terms-of-trade and tendencies towards monopolies and a divergence of growth rates
438 across industries and countries.

439 Kaldor (1966) and his use of Verdoorn's law caused an intensive debate regarding
440 its theoretical implications. While Verdoorn might have stopped believing in a law-like
441 relationship, others did not. Since the 1950s there has been a plethora of studies trying
442 to estimate 'Verdoorn's law'. While the overwhelming majority seems to find positive
443 results (if statistically significant) for such a relation, there is no real consensus about
444 its overall strength.

445 It is important to remember that Verdoorn himself never referred to his findings
446 as a law-like relation. Indeed, in an exchange of letters with A. P. Thirlwall, Verdoorn
447 explicitly forbid the publication of an English translation of his own work by Thirlwall,

average productivity will rise.

448 stating that, unlike at the time of the original publication, he was now convinced that
449 this relationship was only stable at the steady state. Verdoorn restated in 1980 that
450 '*(t)he "law" that has been given my name appears therefore to be much less generally valid*
451 *than I was led to believe in 1949*' (Verdoorn 1980, p.385).

452 In this paper, we conduct a closer and more detailed literature survey using 'meta-
453 regression analysis' (abbreviated MRA from here on). To the best of our knowledge,
454 this is the first MRA ever conducted on Verdoorn's law. For the purpose of this study, a
455 new data set containing 665 estimates of Verdoorn's law from 52 studies (called primary
456 literature from now on) has been created. By date of publication (if published), the
457 studies registered in this data set range from 1966 to 2019, with the primary literature's
458 data sets covering periods between 1800 and 2011. We use this data set to test for the
459 existence of Verdoorn's law. Thus via the use of MRA, we examine the scientific validity
460 of Verdoorn's law not only based on an arbitrary subgroup of studies but the field of
461 research as a whole. Meta-regression analysis is still only emerging in economics but
462 an established standard in other domains such as medicine or psychology.

463 The remainder of this paper is organised as follows: section 1.2 presents the common
464 estimation specifications concerning Verdoorn's law, as well as further issues that might
465 arise during the empirical estimation of Verdoorn's law. Section 1.3 presents MRA as
466 a useful tool for both a complete and detailed literature survey as well as a means to
467 synthesise the different results into an overall result. The section then explains the
468 methodology in detail using FAT-PET-PEESE MRA as state-of-the-art in meta-regression
469 analysis. The search process through the available literature and the structure of the
470 newly created data set is explained in detail in section 1.4. In section 1.5, we conduct a
471 meta-regression analysis on the 52 aforementioned studies estimating Verdoorn's law,
472 using both both simple and multivariate MRA techniques. Section 1.6 concludes.

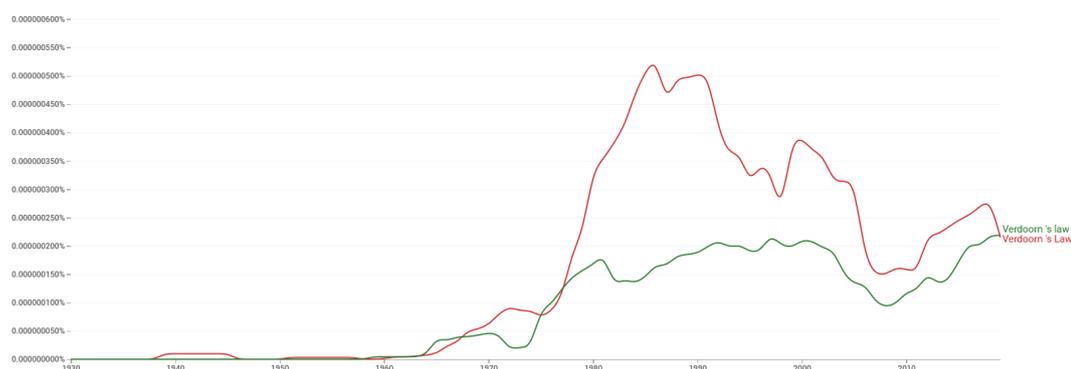


Figure 1.1 – Google Ngram of 'Verdoorn's law'

(a) The values on the y-axis represent the relative share the word 'Verdoorn's law' relative to all words in Google corpus as a percentage.

473 1.2 Verdoorn's law : Estimation, misnomers and the- 474 oretical implications

475 A lot of empirical studies have been conducted on the general validity of his 'law',
476 amongst many others Kaldor (1966), Rowthorn (1975), Stoneman (1979), McCombie
477 (1982a), McCombie and Ridder (1984), Bairam (1987), Targetti and Foti (1997), Leon-
478 Ledesma (2002), McCombie, Pugno, and Soro (2002), and Storm and Naastepad (2013).
479 The largest part of those studies were published in the 1980s and in general the debate
480 on Verdoorn's law reached its peak during the 1980s, as can be seen in the following
481 *GoogleNgram* plot in Figure 1.2a.

482 During the 1990s, interest in the possible existence of the Verdoorn effect declined
483 again, with a short renewal around the year 2000. Only in the recent decade there
484 seems to be renewed interest in this topic, which might have to do with the emerging
485 idea of a future period of 'secular stagnation' among economists (Hansen 1938; Gordon
486 2015; Storm 2017). In such a period, innovation would have to play a key role and thus

487 the determinants of productivity growth become increasingly important again.

488 An attempt at summarising the available econometric literature on the Verdoorn
489 effect has been made by McCombie, Pugno, and Soro (2002), who surveyed the literature
490 dating from Verdoorn's first publication on this topic in 1949 until 2001. The authors
491 conclude that a one percentage point increase in output growth raises productivity
492 growth between 0.3 and 0.6 percentage points. This relationship generally holds in
493 sector-wide, single country or regional studies, and in different forms of estimations,
494 for example cross-section estimations or time series. McCombie, Pugno, and Soro (2002)
495 give a historical survey of Verdoorn's (1949) work and in particular its impact on the
496 work of Nicholas Kaldor. They also discuss several methodological issues as well as
497 the different interpretations of this law-like relationship and its application to several
498 growth models. McCombie, Pugno, and Soro (2002) also include a thorough literature
499 review of studies estimating the overall effect from 1949 until 2001, finding that

500 *'On the whole, the law appears to be largely substantiated in these studies, al-*
501 *though, as is the case for most statistical economic relationships, the estimates*
502 *sometimes need to be qualified. Indeed, in certain circumstances, the law still*
503 *needs further work to solve a number of econometric problems. However, it is*
504 *fair to say that Verdoorn's Law should be regarded as something more than*
505 *just a 'stylised fact'*"(McCombie, Pugno, and Soro 2002, p.1).

506 Hein (2014) extends this survey by several recent studies and reaches similar con-
507 clusions.

508 In econometric terms, Verdoorn's law can be estimated in different ways, all starting
509 from the basic identity between productivity growth productivity growth, output
510 growth output/demand growth and employment growth employment growth.

$$\dot{y} \stackrel{!}{=} \dot{q} - \dot{e}$$

511

512 The straightforward method consists in estimating productivity growth \dot{y} as a func-
 513 tion of output growth \dot{q} , where α_1 is a constant and β_1 the coefficient of output/demand
 514 growth (the 'Verdoorn coefficient'). This is the method used by Verdoorn (1949) himself.

$$\dot{y}_i = \alpha_i + \beta_1 \dot{q}_i + \epsilon_i \quad (1.1)$$

515 Productivity growth \dot{y}_i is supposed to be positively correlated with the growth of
 516 output \dot{q}_i . The importance of this relationship lies in its implications for economic
 517 development, suggesting that a substantial part of productivity growth is endogenous
 518 to the growth process due to *macroeconomic* economies of scale. If we do assume that
 519 the relation underlying Verdoorn's law is based on a Cobb-Douglas production function,
 520 the relationship between the Verdoorn coefficient and the output elasticities of capital
 521 output elasticity of capital and labour output elasticity of labour are given by $\beta_1 = \frac{\alpha + \beta - 1}{\beta}$
 522 . If α and β are equal, which is a common assumption for manufacturing, then an often
 523 cited Verdoorn coefficient of 0.5 implies increasing returns to scale returns to scale of
 524 around 1.33 ($\mu = \frac{2}{1 + \beta_1}$, since the degree of macroeconomic returns to scale is given by
 525 $\mu = \alpha + \beta$).

526 Now the measurement of productivity itself is a delicate subject. The measurements
 527 of productivity are subject to fundamental problems, of which many were highlighted
 528 during the Cambridge capital controversies (Robinson 1953; Samuelson 1966; Sraffa
 529 1975). We might thus be interested in a re-specification of Verdoorn's law without the
 530 use of productivity growth.

531 In his famous inaugural lecture on the reasons for the low growth rate of the post-
532 war UK, Kaldor (1966) stressed the macroeconomic impact of aggregate demand on
533 growth. Kaldor argued in the tradition of his mentor Allyn Young. According to Young
534 (1928), Verdoorn's (1949) findings were supposed to be reflecting both static as well
535 as dynamic increasing returns to scale at the macroeconomic, not the microeconomic
536 level. Young argued that because of higher demand and competition, firms where under
537 stress to separate internal production processes into separate firms in order to lower
538 production costs. This allowed for more specialised firms, new production processes
539 and the rise of new subsidiary industries. A similar argument, although only at the firm
540 level, can already be found in Adam Smith's *Wealth of Nations* (Smith 1776), namely
541 that the division of labour increases with the activity of the market. If Young (1928)
542 was right, Verdoorn's law would only be identified at the industry, regional or national
543 level, but not at the firm level.

544 Kaldor (1966) argued that this effect was prevalent especially in the manufactur-
545 ing sector, as 'industry is the engine of growth'. Furthermore, increasing returns to
546 scale imply a divergence, rather than a convergence of international growth rates and
547 form the basis of Kaldorian cumulative causation models of economic growth. Higher
548 (foreign) demand and the following increase in output leads to higher productivity
549 gains, which translate to lower production costs and thus to bigger market shares and
550 again to higher foreign demand. As Verdoorn's law is supposed to be stronger in the
551 manufacturing sector than in non-manufacturing sectors, de-industrialisation might
552 have hampered long-term growth due to weaker productivity growth. Similarly, in a
553 country with sustained higher growth, the respective country would not necessarily
554 lose in competitiveness since the increase in output would induce higher productiv-
555 ity growth. As a result, GDP growth itself might be reinforcing. On the other hand,

556 a sustained period of slow growth might put a country into a descending spiral of
557 ever-deteriorating competitiveness.

558 Excluding the emphasis on economies of scale, Kaldor (1966) argued that the exis-
559 tence of 'Verdoorn's law', as he called it, proved the importance of aggregate demand
560 for the long-run growth trajectory of the national economy. In other words, growth is
561 demand-constrained, not supply-constrained, and equation 1.1 could be estimated using
562 output growth \dot{q}_i as regressor and \hat{e}_i as regressand. This had the additional benefit of
563 getting rid of the spurious correlation inherent in equation 1.1, as \dot{q}_i can implicitly be
564 found on both the left-hand and right-hand side.

$$\dot{e}_i = \gamma_i + \beta_2 \dot{q}_i + \epsilon_i \quad (1.2)$$

565 or

$$\dot{e}_i = -\alpha_i + (1 - \beta_1) \dot{q}_i + \epsilon_i$$

566 Kaldor (1966) further argued that the reason for the UK's low rate of productivity
567 growth in the manufacturing sector was the exhaustion of labour surplus from other
568 sectors. The prevalent economies of scale in the manufacturing sector could therefore
569 not be used efficiently.

570 This opened up a new debate between Kaldor and Rowthorn (Rowthorn 1975; Kaldor
571 1975). Rowthorn argued that if Kaldor's (1966) argument was true then the economy
572 was ultimately supply-constrained and equation 1.2 was miss-specified, as there is an
573 issue of simultaneous equation bias. Employment growth \hat{e}_i is correlated with wage
574 growth, which in turn is correlated with productivity growth \hat{y}_i . Running regressions
575 on equation 1.2 is therefore not the correct specification. The proper way to estimate

576 Verdoorn's law should therefore be in the opposite way, with employment growth \dot{e}_i as
 577 regressor and output growth \dot{q}_i as regressand.

$$\dot{q}_i = \delta_i + \beta_3 \dot{e}_i + \epsilon_i \quad (1.3)$$

578 or

$$\dot{q} = \frac{\alpha_i}{1 - \beta_1} + \frac{1}{1 - \beta_1} \dot{e} + \epsilon_i$$

579 It should be noted that a series of misunderstandings concerning the names of the
 580 different specifications used to exist. Rowthorn (1975) himself did not use equation 1.3
 581 as the subsequent literature assumes, but rather the following specification, explaining
 582 productivity growth \dot{y} via employment growth \dot{e} .

$$\dot{y}_i = \zeta_i + \beta_4 \dot{e}_i + \epsilon_i \quad (1.4)$$

583 or

$$\dot{y}_i = \frac{\alpha_i}{1 - \beta_1} + \frac{\beta_1}{1 - \beta_1} \dot{e}_i + \epsilon_i$$

584 In his study, Rowthorn (1975) always used equation 1.4 for estimation purposes,
 585 even though, in a fleeting manner, he mentions equation 1.3 as well. Apparently, it
 586 was John McCombie who coined the term 'Rowthorn's specification' for equation
 587 1.3 in a series of studies (McCombie 1982a; McCombie 1982b; McCombie and Ridder
 588 1984; McCombie 1986), while one could argue that the 'true' specification according to
 589 Rowthorn (1975) would be equation 1.4. Still, most economists today refer to equation
 590 1.3 when debating Rowthorn's (1975) approach. Therefore, for the sake of convenience,

591 we will name equation 1.3 'Rowthorn's first specification' and 1.4 'Rowthorn's second
592 specification' for the remainder of this study.

593 Unfortunately, the misunderstandings do not stop here, since Rowthorn (1975) calls
594 the term $\frac{\beta_1}{1-\beta_1}\dot{e}$ inherent in equation 1.4 'Kaldor's implicit estimator' (Rowthorn 1975,
595 p.16). Kaldor (1966) however never used this term, as he favoured equation 1.2 over
596 1.4. Indeed, in a reply to Rowthorn (1975), Kaldor (1975) explains that the case of the
597 UK labour shortage was an exception and his choice of specification was related to his
598 conviction that the economy as a whole was ultimately demand-constrained, rather
599 than supply-constrained.

600 *'The important implication of these assumptions is that economic growth is*
601 *demand-induced, and not resource-constrained - i.e. that it is to be explained*
602 *by the growth of demand which is exogenous to the industrial sector' and not*
603 *by the (endogenously given) growth rates of the factors of production, labour*
604 *and capital, combined with some (endogenously given) technical progress over*
605 *time.'* (Kaldor 1975, p.895)

606 The overall result has thus to be classified by the estimation technique used, as *a*
607 *priori*, there is no objective way to know whether specification 1.2 or 1.3 is correct.
608 Indeed, it is impossible to choose a 'correct' specification without an implicit economic
609 theory as guiding principle. If one believes that output growth is demand-constrained
610 rather than supply-constrained, then equation 1.2 would be the correct interpretation
611 rather than Rowthorn's (1975) formulation, represented by equation 1.3.

612 There exist several issues concerning the correct estimation of Verdoorn's law. One
613 interpretation of the Kaldor-Verdoorn law is that it is a specification of a technical
614 progress function. Kaldor from the very beginning emphasised the importance of the

615 *rate of growth* of output, rather than its *level* for the Verdoorn law. Nevertheless, it
616 can be shown that the linear technical progress function inherent in the Verdoorn
617 law can be derived from a traditional Cobb-Douglas production function (McCombie,
618 Pugno, and Soro 2002). This is important because if the underlying relation of the
619 linear progress function should really be a Cobb-Douglas production function, there
620 would not be much novelty in the approach put forward by Kaldor. Compared to the
621 traditional *dynamic* form of the Kaldor-Verdoorn law in growth rates, the alternative
622 method of obtaining the estimation specification consists in regressing the logarithmic
623 *level* of productivity on the logarithmic level of output. A priori, both the dynamic as
624 well as the static forms should yield the same results, but there exists a paradoxical
625 finding concerning the functional form of Verdoorn's law estimation specification.
626 While the dynamic form usually finds Verdoorn specification values smaller than 1,
627 indicating increasing returns to scale, the *static* version of the Kaldor-Verdoorn law
628 normally finds values close to 1, indicating constant returns to scale² (McCombie 1981;
629 McCombie 1982a; Fingleton and McCombie 1998; Destefanis 2002). One explanation
630 for this is the possible existence of a 'second-order identification problem'. There
631 might be many different underlying structures of the dynamic law depending on the
632 constant of integration. The different results of the dynamic and static forms could
633 thus indicate that the Verdoorn law may not rely on a conventional Cobb-Douglas
634 production function.

635 As was laid out in the previous section, it is impossible to choose an econometric
636 specification of Verdoorn's law without making an implicit value of judgement on
637 whether the economy is supply- or demand-constrained first. Depending on whether
638 the researcher sees the economy as ultimately supply- or demand-constrained, the

²remember that $\mu = \frac{2}{1+\beta_1}$.

639 opposite specification will appear to suffer from simultaneous equation bias, without
640 any proper way to empirically test the underlying economic theory before. Additionally,
641 due to the idea of cumulative causation there is the possibility that both \dot{q} and \dot{e} are
642 endogenous in nature. In this case, both Kaldor's, as well as Rowthorn's specification
643 would be subject to simultaneous equation bias. Normally, a straightforward solution
644 to this problem could consist in using an instrumental variable approach. In this case
645 this is not feasible, as the instrument changes depending on whether we use \dot{q} or \dot{e} as
646 regressor. Another open question is whether or not to include the capital stock as a
647 control variable. Again, Kaldor (1968) argued that the stock of capital should not be
648 included in the estimation, as 'capital accumulation is a symptom rather than cause
649 of growth' (p. 390). Another opportunity lies in using total factor inputs as proxies³,
650 because the stock of capital is already implicitly taken into account this way.

651 Rowthorn (1975) argued that most of Japan's growth experience after World War II
652 could be attributed to its' technological catching-up to other more advanced countries,
653 which would have nothing to do with Verdoorn's law. Hence, one should add as a control
654 variable the initial level of productivity relative to that of more advanced countries
655 (for example the US) when estimating Verdoorn's law. However this does not solve
656 the problem, as due to existing economies of scale the levels of productivity will vary
657 amongst countries even when they all have access to the same technological blueprints.

658 A number of studies have used time series-data. This can lead to problems due
659 to changes in the use of capital and labour over the economic cycle. For example,
660 labour hoarding during the downswing of the cycle might lead to an artificial positive
661 relationship between the growth of output and that of productivity. This relationship is
662 only a short-run phenomenon and is representing 'Okun's law', not Verdoorn's law.

³defined as $\alpha e + (1 - \alpha)k$ where α and $(1 - \alpha)$ are the shares of labour and capital in total income.

663 Furthermore, there are problems caused by the failure to adjust control variables like the
664 capital stock for changes in capacity utilisation over the business cycle. It is therefore
665 recommended to estimate the Kaldor Verdoorn effect using average growth rates in
666 cross-sectional models, with peaks of the growth cycle for first and last years in the
667 data set.

668 If the interpretation of Verdoorn (1949) is correct, then the reason for Verdoorn's law
669 needs to be looked for in the literature on the 'manufacturing progress function': the
670 idea that an increase in *cumulated* output creates the possibility for a greater division
671 of labour, which would help to develop static internal and dynamic external economies
672 of scale. Such a theory implies that Verdoorn's law is indeed a macroeconomic phe-
673 nomenon and as such cannot be found when using firm level data. This means that
674 sectoral, regional or national level data need to be used in order to properly estimate
675 Verdoorn's law. The use of regional data also has the advantage that it can account
676 for differences in institutional layout across countries as was discussed in the previous
677 subsection. But there is still no agreed description as to how exactly Verdoorn's law is
678 supposed to work *in detail*. Consequently, there can be no clear consensus whether to
679 preferably use sectoral, regional or national data.

680 In a similar vein, one might argue that wage growth should be included as a control
681 variable to take into account the so-called 'Marx-Webb effect' (Lavoie 2017a), whereby
682 an increase in wages is pressuring capitalists to invest into labour-saving machinery,
683 thus increasing productivity growth (Storm and Naastepad 2011; Storm and Naastepad
684 2013; Storm and Naastepad 2017; Hein 2014).

685 **1.3 Meta-regression analysis (MRA) as a quantitative** 686 **literature survey**

687 In this section, we will be presenting meta-regression analysis as a method to explain
688 the heterogeneity in results concerning Verdoorn's law. Meta-Regression Analysis
689 (MRA hereafter) builds upon a technique commonly known as 'meta analysis' in other
690 fields like psychological and educational research, medicine and the social sciences
691 (Stanley and Jarrell 2005). Meta analysis tries to summarise and integrate the existing
692 empirical literature about a common parameter. As such, it presents a systematic review
693 of all scientific knowledge currently available and explains the given findings in all its
694 vast variety in a comprehensive way (Stanley and Doucouliagos 2012).

695 **1.3.1 The specification problem**

696 Traditional literature surveys are often not able to present an all-encompassing survey
697 of already existing studies, one of the obvious reasons being the word limit imposed by
698 academic journals. But there is more to it. As Stanley and Jarrell (2005) argue,

699 *'The reviewer often impressionistically chooses which studies to include in his*
700 *review, what weights to attach to the results of these studies, how to interpret*
701 *those results, and which factors are responsible for the differences among those*
702 *results. Traditionally, economists have not formally adopted any systematic or*
703 *objective policy for dealing with the critical issues which surround literature*
704 *surveys As a result, reviews are rarely persuasive to those who do not already*
705 *number among the converted.'* (Stanley and Jarrell 2005, p. 300)

706 Meta analysis can thus be of great help when it comes to examining a certain effect
707 on which a lot of empirical studies have been published – it enables the researcher
708 to see the bigger picture. Additionally, MRA offers the tools to estimate the effect of
709 different model specifications on the overall results and their significance. This way the
710 researcher can distinguish true economic effects from disturbances caused by wrong
711 model specification more easily.

712 Another reason for the use of MRA is the file drawer problem: as the standard error
713 of the estimated correlations are becoming smaller with an increase in the number of
714 observations number of observations, studies using a data set with a comparatively
715 small amount of observations face higher difficulties to obtain significant results. This
716 might become important insofar as peer-reviewed journals may prefer publishing only
717 studies that offer significant results, even though from a methodological and theoretical
718 point of view the publication of not significant results would be equally important for
719 the progress of economics. Such strict publication policies might incentivise researchers
720 to alter their estimation model successively until significant results have been obtained
721 (publication selection bias). In the worst case scenario, the researcher(s) might not
722 publish their findings at all – the study stays in the file drawer.

723 Meta analysis has been increasingly used in the economics literature during the
724 past decades. The most commonly quoted studies include Rose and Stanley (2005) on
725 the effect of common currencies on international trade, Doucouliagos (2005) on the link
726 between freedom and economic growth, Nijkamp and Poot (2005) on the unemployment
727 elasticity of wages, Weichselbaumer and Winter-Ebmer (2005) on the gender wage gap,
728 Knell and Stix (2005) on the income elasticity of money demand and Doucouliagos and
729 Stanley (2009) on the effect of minimum wages on employment.

730 While MRA has become a well-accepted approach in other scientific fields, its

731 appearance in economics is yet a comparatively rare sight. Nevertheless, a guideline for
732 a more standardised use of MRA in economics has been proposed by the Meta-Analysis
733 of Economics Research Network (MAER) in order to improve both the transparency
734 and the quality of future Meta analysis.

735 While the estimation methods used in meta-regression analysis are not overly
736 complex, the previous stages are very intensive work-wise as well as time-wise. To
737 conduct a MRA, there are several steps to be followed. First, the researcher is collecting
738 all available studies on a specific effect she or he wants to study. These studies are
739 called 'primary literature' amongst meta-regression analysts. Whether those studies
740 are published in peer-reviewed journals or not should *a priori* not play any role. Indeed,
741 one is even encouraged to include non-published studies, as the fact that the studies
742 are unpublished need not necessarily indicate unscientific methods or a lower quality
743 with respect to the used methods, but rather point at potential publication selection
744 bias, as was explained in the former section.

745 In a second step, the reported estimates in these gathered studies are being treated
746 as individual entries in a new data set. For a study to be included in the data set,
747 the researcher has to code at least the estimate, and the corresponding t-value (or
748 its standard error). If those two variables can be obtained, then the estimate can be
749 included in the data set. Furthermore, the researcher might be interested in adding
750 several characteristic elements of the specific study that might be worth considering
751 in the form of dummies, such as the sources of the data sets being used, the year
752 of publication (if the paper is published), the method of estimation, the country or
753 sector examined *etc.* This possibility is in fact one of the advantages of MRA. Not only
754 is it possible to infer a more precise estimate for any given variable, but MRA also
755 enables the researcher to find out which socio-economic circumstances might skew the

756 estimated results and lead to possible under- or overestimation of the effect in question.
757 Finding and explaining these differences via MRA is based on statistical, not economic
758 theory and can thus help to shed light into controversies between different schools of
759 thought. This implies that the researcher conducting MRA is well-aware of the available
760 literature, not only with regards to empirical estimation methods, but especially the
761 theoretical discussion and potential differences in interpretation resulting from this.

762 The third step consists of a two-step regression in which the first regression points
763 at the presence or absence of publication selection bias (called the Funnel asymmetry
764 test, or (FAT)-test) – which in the existing MRA literature has almost always been
765 found – while the second regression tries to estimate this very publication selection
766 bias and the 'true value' of the parameter in question (called the Precision effect test, or
767 (PET)-test).

768 **1.3.2 The basic model**

769 Following Stanley and Jarrell (2005), the most common approach to do meta-analysis in
770 economics consists in using effect sizes in reported econometric studies. The following
771 section builds mostly on Stanley and Doucouliagos (2012), as well as the guidelines
772 published by the MAER network (Stanley, Doucouliagos, et al. 2013). The notation used
773 in the following section is drawing from Paldam (2015).

774 In order to be used for MRA, studies that estimate Verdoorn's law are collected
775 only when they meet two conditions. First, the studies collected must be estimating
776 comparable effects (Becker and Wu 2007). In order to make them comparable MRA
777 studies are using effect sizes.

778 Secondly, the studies have to be transparent, in that the researcher is able to gather

779 at least the estimated coefficient, its corresponding standard error standard error or
 780 t-value t-statistics of the primary literature, and the number of observations used
 781 in the primary literature in order to compute the corresponding partial correlations
 782 partial correlation. Partial correlations are helpful because they are able to standardise
 783 effect sizes of different size and quality, a difficulty that is encountered very often in
 784 MRA. Their ability to make all studies comparable to each other is their most desirable
 785 property, as it enables the researcher to get more information about the state of the
 786 literature. Partial correlations are computed as presented,

$$r = \frac{t}{\sqrt{t^2 + df}}$$

787 with its corresponding standard error being $se_r = \sqrt{\frac{1-r^2}{df}}$. Partial correlations
 788 are not easy to interpret, as their nature is more statistical rather than economic.
 789 Standardised partial coefficients can be interpreted as the number of standard deviations
 790 the dependent variable increases for every increase in the standard deviation of the
 791 independent variable, holding all other variables constant. It is therefore desirable to
 792 use additional effect sizes to get results that can easily be interpreted in economic terms.
 793 Nevertheless the desirable properties that partial correlations have with respect to other
 794 effect sizes makes them the most used effect size in MRA (Stanley and Doucouliagos
 795 2012).

796 MRA uses the relation between an effect size b_i and its precision precision (the
 797 inverse of its standard error se_i) to draw its conclusions. Consider a sample of estimated
 798 studies with reported estimates b_i and an underlying effect γ_0 .

$$b_i = \gamma_0 + \gamma_1 se_i + \epsilon_i \quad (1.5)$$

799 In this case, the reported estimates should all be randomly and symmetrically
 800 distributed around the true underlying value, γ_0 . As the term 'true value' can be seen
 801 as rather problematic, the term 'meta-average' will be used from now on. In the end,
 802 all that MRA does is constructing an average of all estimates corrected for publication
 803 bias (Stanley and Doucouliagos 2012).

804 The idea of publication selection assumes that researchers with a smaller sample and
 805 thus higher standard errors are forced to search longer for statistically significant results
 806 than their colleagues with bigger samples (for example via searching for additional data
 807 or for reasons to eliminate 'potential outliers'). The latter ones will be satisfied with
 808 their potentially smaller, but significant estimates. Hence, in the case of publication
 809 selection, the estimate will be positively correlated with the standard error se_i . This
 810 forces the estimates to become larger than they should be (i.e. there is overestimation)
 811 in order to become statistically significant. Hence, $\gamma_1 se_i$ describes potential publication
 812 selection bias and γ_0 describes the meta-average, corrected for potential publication
 813 bias (as $se_i \rightarrow 0$, $E(b_i) \rightarrow \gamma_0$). Since MRA is using estimates from different studies, those
 814 estimates will typically embody differing variances, which will have to be normalised in
 815 order to take care of heteroskedasticity issues. The errors can be weighted via dividing
 816 equation 1.5 over the reported estimate's standard error. Dividing by se_i will give us
 817 a weighted-least-squares (WLS) estimation of equation 1.5, which is in fact a basic
 818 MRA of the estimate's t-value against its precision, $p = \frac{1}{se_i}$. In case of homogeneity, the
 819 former error divided by the measured sampling error must be equal to 1.

$$t_i = \gamma_0 p_i + \gamma_1 + v_i \quad (1.6)$$

820 t_i refers to the estimate's t-value and γ_0 is the 'meta-average' – the average effect of

821 the primary literature corrected for publication bias – with p being the 'precision score'
 822 $\frac{1}{se_i}$. Equation 1.6 can equally be rewritten as $t_i = \gamma_0 \frac{1}{se_i} + \gamma_1 + v_i$. Both parts of equations
 823 1.5 and/or 1.6 (depending on the chosen effect size) are being used for testing. Testing
 824 γ_1 in equation 1.5 or γ_1 in equation 1.6 for the null hypothesis that $\gamma_1 = 0$ or $\gamma_1 = 0$
 825 is called the 'funnel-asymmetry test' (FAT-test) part of the FAT-PET and checks for
 826 heterogeneity. A rejection of the null hypothesis points at the existence of publication
 827 selection bias. $\gamma_0 = 0$ in equation 1.5 and $\gamma_0 = 0$ in equation 1.6 represents the 'precision
 828 estimate test' (PET-test) part of the FAT-PET and is used to estimate the meta-average
 829 in case of publication selection bias. Estimates far away from the underlying effect
 830 should have low precision, while estimates closer to the 'true effect' should have high
 831 precision. At the same time, the precision score itself acts as a weight. Estimates with a
 832 higher precision will have a higher weight when estimating the meta-average than low
 833 level precision estimates.

834 The FAT-PET test thus enables MRA to not only find out about the possible existence
 835 of publication selection bias, but to also correct the ordinary average of the reported
 836 estimates for the estimated publication selection bias in order to get a 'cleaner' estimate
 837 closer to the actual underlying effect (provided such an effect exists). However, even the
 838 PET-test gives a biased estimate of the empirical effect in case of publication selection.

839 Doucouliagos and Stanley (2009) and Stanley and Doucouliagos (2012) offer an
 840 improved correction for publication selection that uses the effect size's variance (i.e.
 841 the square of the standard error) in MRA modelling, the Precision-Effect Estimate with
 842 Standard Error (PEESE) test.

$$b_i = \gamma_0 p_i + \gamma_1 se_i^2 + v_i \quad (1.7)$$

843 The FAT-PET-PEESE tests are supposed to be used one after another. Monte Carlo
 844 simulations have shown that the PEESE provides a better estimate of the underlying
 845 true effect (Stanley and Doucouliagos 2014). However, this is not true when there is no
 846 effect and only publication selection. If the PET-test indicates a genuine underlying
 847 effect then the researcher is expected to run the PEESE-test for a more robust estimate.

848 1.3.3 Multiple MRA

849 Clearly, it will often be the case that potential misspecification in the literature will not
 850 be able to be explained solely by publication bias. Rather, there might be reasonable
 851 differences amongst the available studies that can explain part of this misspecification.
 852 That being said, it can be interesting to obtain more details about publication bias, what
 853 study-specific characteristics drive it, and when there might be more general sources
 854 of misspecification that transcend the population sample (such as a dominant theory
 855 that is perceived to perform better than others or certain results that are expected by
 856 the scientific community beforehand).

857 The basic MRA equation 1.5 can be expanded in order to take these intricacies into
 858 account.

$$b_i = \gamma_0 + \sum \gamma_k Z_{ki} + \gamma_1 se_i + \sum \delta_j se_i K_{ji} + \epsilon_i \quad (1.8)$$

859 Equation 1.8 can be interpreted similarly to equation 1.5. The reported estimates b_i
 860 are still assumed to be randomly and equally distributed around the meta-average γ_0 ,
 861 with two different sources of misspecification present. The first, $\sum \gamma_k Z_{ki}$, represents
 862 all the discrepancies due to heterogeneity amongst the studies and the second, $\gamma_1 se_i +$
 863 $\sum \delta_j se_i K_{ji}$, represents publication bias. δ represents dummy variables which are called

864 'moderator variables' in the MRA literature. Moderator variables can help gathering
865 more information about the available literature than represented by just their respective
866 output tables. The most used moderator variables include the year of publication, the
867 journal of publication, the year span covered in the data set and many other study-
868 specific characteristics.

869 **1.4 The data set**

870 The literature search process as well as the ensuing coding of this present study was
871 based on the MAER-NET guidelines in Stanley, Doucouliagos, et al. (2013). The plat-
872 forms used for finding the relevant studies cover the biggest array possible in order to
873 account for as many studies as possible and consist of Econlit, JStore, Google Scholar
874 and Google Search. Keywords for the searching process were 'Verdoorn effect', 'Ver-
875 doorn's law' and similar terms such as 'Kaldor-Verdoorn effect' and 'Kaldor's second
876 law', 'productivity', 'productivity-growth nexus' and others relevant. In addition, the
877 search was extended to the list of references (or footnotes) found in the primary litera-
878 ture. The literature search was finished on February 30th 2020. In order to be eligible for
879 inclusion in the data set, the studies had to match certain criteria. First of all, the studies
880 on Verdoorn's law had to be written in either English, German, French or Spanish, the
881 languages spoken by the authors.

882 The following step included extracting the estimated coefficient, its t-values and
883 standard errors, the number of observations and/or the degrees of freedom from every
884 specific regression for each single study. Additionally, several other variables of possible
885 interest were recorded as dummies for further analysis. For robustness checks in form
886 of other effect sizes, more variables should be included. The number of observed

887 variables/the degrees of freedom are very important in this regard, since they can
888 be used to compute partial correlations which are a further effect size apart from the
889 elasticities commonly used in MRA. This might be explained by their date of publication.
890 Econometric standards were not as agreed upon in economics in the 1980s as they are
891 today. Furthermore, without the use of powerful statistical programs that are available
892 to us today, doing econometric estimations was far more challenging. This naturally
893 diminishes the explanatory power of this MRA since less studies can be investigated
894 upon. Whenever the corresponding number of observations was not reported, it was
895 estimated using the overall years covered in the respective data sets. This creates
896 some potential for errors in our studies but was preferable compared to losing a higher
897 amount of studies and therefore explanatory power for our analysis. Studies that failed
898 to adhere to these criteria were not included. The literature search left as a result 74
899 studies, of which 22 had to be rejected. The resulting data set contains 52 studies with
900 665 estimates of Verdoorn's law⁴. As such, it is the first database on Kaldor-Verdoorn
901 coefficient estimates so far and is created completely anew. The years covered in the
902 respective literature range from 1800 to 2011.

903 A key issue is that most of the studies found were not reporting all the key variables
904 needed. For an MRA to be done, the database needs to contain at least the estimate,
905 and either the corresponding standard error or its t-value (since the t-value is the ratio
906 of the estimate divided by the standard error, assuming that the null hypothesis is $b =$
907 0). Most of the 52 studies in the data set did not explicitly state their null hypotheses.
908 In theory, this makes it impossible to calculate missing standard errors or t-statistics if
909 needed (and in consequence the resulting partial correlations cannot be derived). For

⁴The data set used in this study will be published in the meta-data repository together with a list of papers not included and the reason for their rejection shortly after this study is accepted for publication.

910 the present study, the null hypothesis was assumed to be $b = 0$ if not stated otherwise.
911 The omission of the null hypothesis is no trivial problem. If not stated anywhere in the
912 literature, it is not possible to follow the authors' calculations in a transparent way, as
913 any null hypothesis could be assumed in order to get statistically significant results. For
914 example, some regressions exhibit positive estimates but negative t-statistics. This is
915 only possible if the null hypothesis is assumed to be smaller than 0 - but this has never
916 been mentioned in the respective study. Assuming $b = 0$ for the null hypothesis might
917 thus severely underestimate publication bias if the null hypotheses actually chosen
918 were different.

919 The existence of four different estimation specifications in the case of the Kaldor-
920 Verdoorn literature (Verdoorn's specification, Kaldor's specification and Rowthorn's
921 first and second specification) further complicates the use of MRA methods. Ideally,
922 all estimates would be transformed in one of the four specifications in order to make
923 them directly comparable and increase explanatory power. The Kaldor specification
924 can easily be transformed into the Verdoorn specification (called 'Kaldor-Verdoorn
925 specification' from now on), while the corresponding standard errors stay the same.
926 In the case of Rowthorn's first and second specification however, the standard errors
927 would change as a result of the transformation and would need to be calculated using
928 the delta method. In our case, however, this is not possible due to missing sample
929 means in the primary literature. In theory, one could construct new data sets with
930 corresponding sample means using external sources for every respective estimate. In
931 practice this possibility is flawed for two reasons. First, it creates another potential
932 source of bias in this analysis. Second, in panel and cross-sectional studies it is often
933 not recognisable which countries entered a specific estimation. This could lead to the
934 inclusion of the wrong number of countries in the external data and thus create wrong

935 sample means. For these reasons, our study will therefore abstain from doing so and
936 focus most of its attention on the Kaldor-Verdoorn specification alone. Luckily, with
937 507 out of 665 estimates, the Kaldor-Verdoorn specification covers most of the primary
938 literature estimates. As a result, we will use three specifications for the remainder
939 of this analysis: the Kaldor-Verdoorn specification, Rowthorn's first specification and
940 Rowthorn's second specification.

941 The variance of the estimated effect in equation 1.5 and hence u will vary between
942 reported estimates. In order to deal with potential heteroskedasticity, weighted least
943 square (WLS) estimation, similar to equation 1.6, is being used. As every estimate gets
944 weighted with its corresponding standard error, estimates with large standard errors are
945 given smaller weight while more precise estimators are given more weight. This makes
946 WLS-MRA more resistant to outliers. Nevertheless, we used studentised residuals in
947 order to minimise the effect of outliers. For testing reasons, regressions were first
948 run without specifying vce parameters like weights or cluster-robust standard errors.
949 Then studentised residuals were created. Since the residuals behave like t-statistics,
950 the critical value for elimination was chosen to be 1.96. If the absolute value of the
951 residuals exceeded this critical value, the respective data point were considered as an
952 outlier and deleted from the final sample. After this, the normal regressions with vce
953 parameters were run. All in all, 28 estimates had to be dropped after using this method.

954 Figure 1.3 summarises the distribution of 665 estimates from 52 studies over the
955 different estimation models discussed in this section. Even though most of the available
956 studies hint at the presence of such an effect as Verdoorn (1949) described, the size
957 of the reported overall effect is not clear. Based on this descriptive representation, if
958 Verdoorn's law is real, the resulting estimated effect seems to be differing according to
959 the estimation specification chosen.

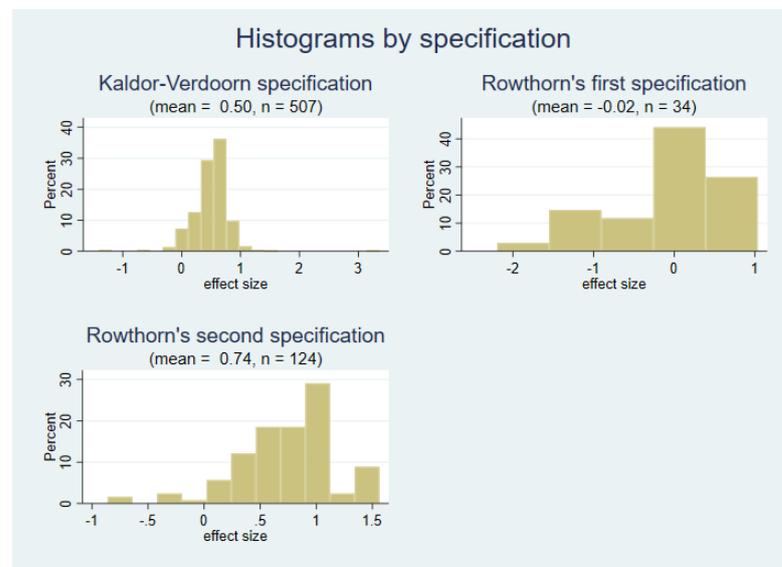


Figure 1.3 – Histogram of the different estimation specifications

960 Figure 1.4 presents the combined 665 observations from 52 studies on Verdoorn's
 961 law with years of publication ranging from 1966 to 2019 in a scatter plot called the
 962 'funnel plot'. Funnel plots are a representation of reported estimates commonly used in
 963 MRA.

964 The funnel plot, even though only being descriptive in nature, is useful for an initial
 965 overview of the existing literature. It plots the distribution of all reported estimates in
 966 the primary studies against their precision (the inverse of their corresponding standard
 967 error). In case of homogeneity, the reported estimates should be randomly distributed
 968 around the meta-average, with estimates decreasing in precision the further away
 969 they are from the meta-average. A skewed distribution of reported estimates can be
 970 interpreted as a first hint of possible publication selection bias. The average estimated
 971 value for Verdoorn's law depends on whether the Kaldor-Verdoorn specification (0.50),
 972 Rowthorn's first specification (-0.02) or Rowthorn's second specification (0.74) is ob-
 973 served and is marked in the corresponding graphs with a dashed red line. All three

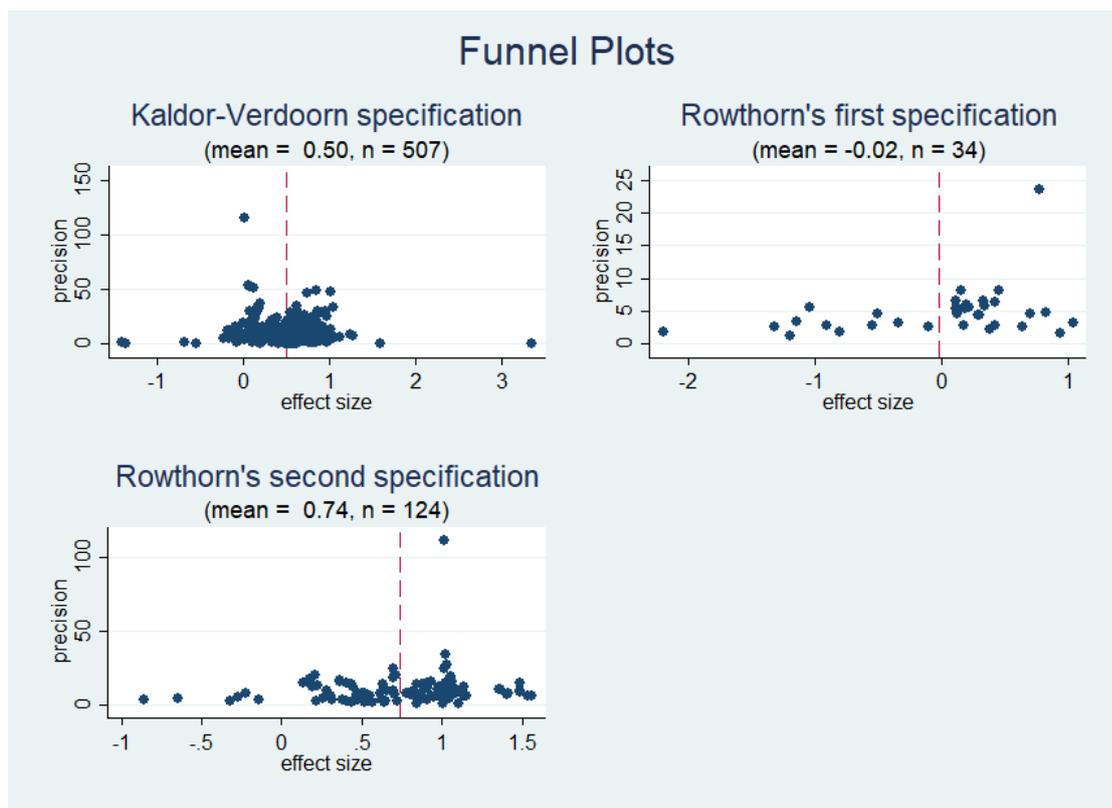


Figure 1.4 – Funnel Plots, separated by specification

974 specifications seem to indicate a tendency towards one most precise point, with the
975 Kaldor-Verdoorn specification hinting at a second group of high-precision estimates.
976 No graph really shows a symmetric distribution of estimates around the high-precision
977 estimates, which can be interpreted as a first hint at potential publication bias.

978 With descriptive analysis giving us first insights, we can now turn to a more
979 thorough investigation.

980 **1.5 A Meta-regression analysis on Verdoorn's law**

981 Another problem usually faced in meta-analysis is the fact that different studies report
982 a different number of estimates. Thus, single studies with a high number of reported
983 estimates might dominate the overall sample (Stanley and Doucouliagos 2012, pp. 99).
984 It is thus common for MRA studies to use cluster-robust standard errors in order to
985 take this possibility into account. Unless stated otherwise, all following regression
986 specifications were run in effect form with $\frac{1}{SE^2}$ as analytical weights.

987 MRA uses a regression between a reported effect size and its standard error as a
988 more objective method of finding and measuring potential publication selection bias.
989 In the absence of publication selection bias, there should be no significant correlation
990 between the estimate and its standard error, while the opposite would be true in case
991 of publication selection bias. Once we account for publication bias we can answer our
992 question of interest: Is there an underlying Verdoorn effect when taking into account a
993 sizeable share of the available literature?

994 A further advantage of MRA is the use of dummy variables to account for the
995 impact of omitted variables and their impact on publication selection bias. Especially
996 in economics, where researchers are often working with pre-compiled data-sets and

important variables might not be taken into account, omitted variable bias might indeed be one of the biggest drivers of misspecification. Similarly, other study-specific properties might be of interest to the researcher if a good summary of the respective literature is desired. Other often used variables include the difference in proxies used to represent the respective effect, nature and origin of the data set, the estimation technique used in the paper as well as year and journal of publication (if published), sources of funding, etc.

As we have discussed in section 1.2, there is a certain paradox regarding Verdoorn's law's value, depending on whether growth rates or logarithms of the level of productivity and output are chosen. The 'dynamic' specification typically finds Verdoorn coefficients around 0.5, implying increasing returns to scale, while the 'static' specification usually finds coefficients implying constant returns to scale. It thus makes sense to distinguish the estimates by their respective dynamic or static nature. Table 1.1 shows the results for a basic meta-regression analysis. The majority of this MRA is only taking into account estimates from the Kaldor-Verdoorn specification. Columns 1 and 4 are the results for the meta-average estimation, assuming no publication bias. Columns 2 and 5 contain the FAT-PET MRA results and columns 3 and 6 show the results for the PEESE MRA. Columns 1-3 analyse all dynamic specification estimates, while columns 4-6 analyse static specification estimates only. In the case of the simple meta-average estimation, the elasticity gets regressed on the constant plus an error term. If the constant thus is statistically significant from zero, we can assume that there is a clear correlation between output and productivity growth and Verdoorn's law is a real mechanism underlying the capitalist economic system. The exact value of the constant then indicates how large the overall effect is.

In our case, the meta-average of the Kaldor-Verdoorn specification in column 1 is

1022 statistically significant, with a value of 0.528. Assuming that there is no publication
1023 bias, Verdoorn's law seems to exist, implying significant increasing returns to scale. This
1024 can however not be said about the static version in column 3, which is not statistically
1025 significant. As was argued before, in theory both the dynamic as well as the static
1026 version should yield the same results. If they do not, the relation underlying the
1027 technical progress function might not be a Cobb-Douglas production function, and the
1028 dynamic and static specifications might measure two entirely different things. However,
1029 most MRA studies find that publication bias is prevalent in most research areas, i.e.
1030 reported estimates of Verdoorn's law do not vary randomly around the meta-average
1031 (as can be seen in the funnel plots in figure 1.4). Publication bias can be represented as a
1032 statistically significant relationship between an effect and its standard error. Columns 2
1033 and 5 show the results for the FAT-PET MRA, which aims at explaining this publication
1034 bias, while also estimating the meta-average corrected for this bias. The FAT-PET
1035 test is defined as $b_i = \gamma_0 + \gamma_1 se_i + \epsilon_i$. Without publication bias, there should be no
1036 correlation left between the reported estimate and its' standard error. Typically, the
1037 FAT-PET MRA will find different results from a simple meta-average estimation. In
1038 the case of no publication bias, the meta-average which is the result of the PET-test
1039 should be very close to the unweighted average of the reported estimates. The PET-test
1040 should thus be taken into account as well. It represents the meta-average, corrected for
1041 potential publication selection bias even if there was none reported via the FAT-test. In
1042 both cases, publication bias associated with the standard error SE_i is not statistically
1043 significant, even at the 10% level, yet the estimated meta-average in case of the dynamic
1044 specification is roughly the same as in column 1. In the case of the static version, again
1045 no underlying effect is left.

1046 However it has to be taken into account that the FAT-test is seen as a relatively

1047 weak test for publication bias by the MRA-community (Stanley and Doucouliagos 2012).
 1048 Let us look at the PEESE MRA, the results of which can be seen in columns 3 and 6.
 1049 The PEESE test is defined as $b_i = \gamma_0 p_i + \gamma_1 se_i^2 + v_i$. In case of publication bias, the
 1050 FAT-PET MRA underestimates the total publication bias. Thus, the MRA literature
 1051 recommends running a PEESE MRA following the FAT-PET MRA. Taking into account
 1052 a non-linear relation between the estimate and its standard error, the meta-average is
 1053 again statistically significant in the case of the dynamic specification and not significant
 1054 in the case of the static specification. As with the FAT-PET MRA in columns 2 and 5,
 1055 the PEESE MRA cannot find statistically significant publication bias.

Table 1.1 – Kaldor-Verdoorn specification: all estimates

	dynamic			static		
	(1)	(2) FAT-PET	(3) PEESE	(4)	(5) FAT-PET	(6) PEESE
SE		0.385 (0.546)			1.097 (1.507)	
SE_SQR			0.000 (0.001)			0.009 (0.013)
Constant	0.528+ (0.038)	0.502+ (0.066)	0.528+ (0.038)	0.282 (0.182)	0.246 (0.213)	0.282 (0.183)
Adjusted R^2	0.00	0.00	-0.00	0.00	0.00	-0.01
Observations	404	404	404	103	103	103
Number of studies	46	46	46	12	12	12
BIC	-64.23	-60.78	-58.23	95.36	98.66	99.99

* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$, + $p < 0.001$; standard errors in parentheses.

1056 Kaldor (1966), however, only believed Verdoorn's law to be existent and important in
 1057 the case of industry. Table 1.2 repeats the analysis from table 1.1 for all manufacturing
 1058 sector estimates, with similar results. The dynamic specification yields strong Verdoorn
 1059 coefficients, although this time a bit smaller than in the full sample. Again, the contrast
 1060 with the dynamic specification could not be any clearer. Our MRA for the static

1061 specification finds no statistically significant meta-average, i.e. the static specification
 1062 finds no sign of existence of Verdoorn's law. While no publication bias can be found
 1063 when taking into account all estimates, in the case of manufacturing, publication
 1064 bias does exist in the case of the static specification, inflating the overall estimation
 1065 result. Comparing the results with table 1.1, it is surprising to find a smaller effect in
 1066 the manufacturing sector (the supposed *engine of growth* according to Kaldor (1968))
 1067 compared to the whole economy.

Table 1.2 – Manufacturing sector only

	dynamic			static		
	(1)	(2)	(3)	(4)	(5)	(6)
		FAT-PET	PEESE		FAT-PET	PEESE
SE		0.338 (0.598)			2.379*** (0.582)	
SE_SQR			0.000 (0.001)			0.021** (0.007)
Constant	0.497+ (0.054)	0.473+ (0.088)	0.497+ (0.054)	0.101 (0.090)	0.038 (0.059)	0.101 (0.091)
Adjusted R^2	0.00	0.00	-0.00	0.00	0.29	-0.02
Observations	293	293	293	57	57	57
Number of studies	30	30	30	7	7	7
BIC	-143.26	-139.81	-137.58	-7.35	-23.65	-3.34

* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$, + $p < 0.001$; standard errors in parentheses.

1068 The form of the Kaldor-Verdoorn law can easily lead to worries about potential
 1069 endogeneity between output growth and productivity growth. Although no specific
 1070 estimator can be used here without making implicit assumptions on whether the
 1071 economy is ultimately supply-constrained or demand-constrained, MRA can be used
 1072 in this case as well. Table 1.3 presents results for all estimates that take into account
 1073 potential endogeneity. The pattern continues, with the dynamic specification finding
 1074 no publication bias and rather high and statistically significant Kaldor-Verdoorn values,

1075 while the static version finds no publication bias and no genuine effect whatsoever.

Table 1.3 – Only estimates which take into account endogeneity

	dynamic			static		
	(1)	(2) FAT-PET	(3) PEESE	(4)	(5) FAT-PET	(6) PEESE
SE		0.475 (0.287)			1.097 (0.403)	
SE_SQR			0.001 (0.001)			0.900 (0.620)
Constant	0.431+ (0.041)	0.396+ (0.047)	0.431+ (0.041)	0.041 (0.025)	0.016 (0.014)	0.040 (0.025)
Adjusted R^2	0.00	0.01	-0.01	0.00	0.36	-0.02
Observations	137	137	137	22	22	22
Number of studies	12	12	12	3	3	3
BIC	45.91	49.08	50.83	-69.83	-77.75	-67.35

* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$, + $p < 0.001$; standard errors in parentheses.

1076 Table 1.4 depicts the MRA results for single-country estimates. Again we find
1077 strong and statistically significant Kaldor-Verdoorn values for the dynamic version
1078 and no genuine effect or publication bias for the static version. Table 1.5 repeats the
1079 analysis with cross-country estimates only, with marginally higher estimates that in
1080 the single-country case being the only difference.

1081 1.5.1 Taking into account study heterogeneity: multivariate MRA

1082 In this section, MRA is used to explain the variance in estimates in its entirety, taking
1083 into account differences in estimation strategies, omitted variables as well as specific
1084 study characteristics. For this analysis, 21 variables are used, which are summarised in
1085 table 1.6.

1086 Most of the variables consist of dummy variables and represent important variables
1087 for the correct estimation specification with regards to Verdoorn's law or try to catch

Table 1.4 – Only single-country estimates

	dynamic			static		
	(1)	(2) FAT-PET	(3) PEESE	(4)	(5) FAT-PET	(6) PEESE
SE		0.549 (0.836)			3.453 (3.055)	
SE_SQR			0.001 (0.001)			30.424 (22.888)
Constant	0.515+ (0.052)	0.478+ (0.094)	0.515+ (0.052)	0.052 (0.046)	-0.010 (0.030)	0.026 (0.018)
Adjusted R^2	0.00	0.01	-0.00	0.00	0.19	0.17
Observations	249	249	249	14	14	14
Number of studies	26	26	26	6	6	6
BIC	-85.30	-82.99	-79.79	-8.83	-10.23	-9.99

* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$, + $p < 0.001$; standard errors in parentheses.

Table 1.5 – Only cross-country estimates

	dynamic			static		
	(1)	(2) FAT-PET	(3) PEESE	(4)	(5) FAT-PET	(6) PEESE
SE		0.218 (0.778)			-1.208 (2.510)	
SE_SQR			-0.052 (0.118)			-0.003 (0.017)
Constant	0.552+ (0.060)	0.537+ (0.104)	0.552+ (0.061)	0.437 (0.227)	0.489 (0.298)	0.437 (0.229)
Adjusted R^2	0.00	-0.00	-0.01	0.00	0.01	-0.01
Observations	155	155	155	89	89	89
Number of studies	20	20	20	6	6	6
BIC	17.97	22.69	22.99	93.69	96.60	98.17

* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$, + $p < 0.001$; standard errors in parentheses.

1088 specific characteristics of the primary studies. The first group of dummy variables
1089 captures differences in estimation strategy *endogeneity* measures whether the studies
1090 tried to correct for endogeneity using either independent variable (*IV*), general method
1091 of moments (*GMM*), limited-information maximum likelihood (*LIML*), two-stages least
1092 squares (*2SLS*), or three-staged least squares (*3SLS*) estimation techniques. Several other
1093 dummies specify other differences in estimation models, such as fixed effects models
1094 (*fixed effects*), random effects models (*random effects*) and non-linear least squares
1095 (*nonlinear*). Given the theoretical debate reviewed in section 1.2, we might be interested
1096 in whether studies did not control for changes in the business cycle, thus estimating
1097 Okun's law instead of Verdoorn's law (*no cycle control*), the stock of capital (*no capital*
1098 *stock*), the difference in technology between countries (*no tech. gap*) or wage growth
1099 (*no wages*) when estimating Verdoorn's law. Additionally, *tfi* specifies whether total
1100 factor inputs were used as a proxy for the stock of capital. The variable *average year*
1101 represents the average year of the studies' data set, normalised to the average of all the
1102 Kaldor-Verdoorn specification estimates (1978). This variable will be used in order to
1103 detect possible time trends, i.e. whether Verdoorn's law became gradually weaker or
1104 stronger over time. The third group of dummies represents differences between studies
1105 that might affect the overall difference in estimates. Specifically, the dummies try to
1106 account for whether the country studied is a member of the OECD (*OECD member*),
1107 whether a single country was studied (*single country*), cross-sectional or timeseries data
1108 were used (*crosssectional, time series*), whether regional data, non-manufacturing data
1109 or all-sector data were used (*regional data, non-manufacturing, all sectors*), whether the
1110 study was not published (*unpublished*) or whether the static Verdoorn law specification
1111 was estimated (*static*).

1112 The resulting constant of our MRA regression will thus constitute the case where

	Verdoorn and Kaldor	Rowthorn	Rowthorn 2
<i>General</i>			
effect size	0.50	-0.02	0.74
SE	0.54	0.29	0.19
<i>Estimation</i>			
endogeneity	0.31	0.26	0.60
fixed effects	0.00	0.00	0.02
random effects	0.00	0.00	0.02
no cycle control	0.54	0.56	0.65
nonlinear	0.01	0.00	0.00
capital stock	0.30	0.53	0.60
no tech. gap	0.86	0.94	0.97
no wages	0.88	1.00	1.00
tfi	0.31	0.03	0.42
<i>Time</i>			
average year	0	-21	-7
<i>Region and Data</i>			
no OECD member	0.14	0.21	0.32
single country	0.52	0.76	0.62
crosssectional	0.10	0.00	0.15
time series	0.38	0.62	0.34
regional data	0.24	0.03	0.28
unpublished	0.05	0.00	0.03
static	0.20	0.00	0.23
non-manufacturing	0.05	0.18	0.06
all sectors	0.26	0.38	0.24
Observations	507	34	124

Table 1.6 – Explanatory variables with averages and number of observations, by estimation specification

1113 all dummy variables are equal to 0. Our baseline specification thus assumes a panel
1114 data analysis using OLS regression of the *dynamic* Kaldor-Verdoorn specification, with
1115 the stock of capital, the technological gap and wage growth. Furthermore, our baseline
1116 scenario analyses multiple OECD member countries, using manufacturing data, with
1117 1978 as the average year of the data set.

1118 Like before, cluster-robust standard errors have been used for the regression. In
1119 addition, a general-to-specific approach via stepwise regression is used as recommended
1120 by Stanley and Doucouliagos (2012). The resulting MRA can be seen in table 1.7. Using
1121 507 estimates of the Kaldor-Verdoorn specification from 49 studies, the FAT-PET MRA
1122 as well as the PEESE MRA find exactly the same results. The reason for this lies in the
1123 fact that no signs of publication bias can be found at the 10% significance level and
1124 therefore both the standard error (in the case of the FAT-PET test) as well as the variance
1125 (in case of the PEESE test) are being dropped during the stepwise approach. The chosen
1126 specification finds a highly significant genuine Verdoorn coefficient of 0.597, which is
1127 in the higher end of the spectrum of the empirical literature. McCombie, Pugno, and
1128 Soro (2002) find that the overall effect size might vary between 0.3 and 0.6. Using MRA,
1129 this study aims to explain these differences in results. Out of the eight statistically
1130 significant variables, four variables (*no OECD member*, *regional data*, *time series* and
1131 *nonlinear*) are correlated with higher reported Verdoorn coefficients. The statistical
1132 significance of *time series* could reflect an overestimation of Verdoorn's law due to a
1133 confusion with the short-run Okun effect. This would be a problem, especially as the
1134 effect of *time series* stays significant during most robustness checks. Since the variable
1135 *no cycle control* yields no significant results, we might assume that the reported results
1136 do not indicate the presence of Okun's law in the empirical literature on Verdoorn's
1137 law. The alternative explanation, of course, would be that the existent controls might

1138 be flawed.

1139 There are two possible explanations as to why non-OECD countries do experience
1140 higher Verdoorn coefficients than OECD member countries. This could either represent
1141 technological catching-up of emerging countries or the global restructuring of indus-
1142 try, with high-income countries becoming more and more service industry-heavy and
1143 middle-income countries becoming more industrialised. Four more variables (*endogene-*
1144 *ity*, *single country*, *regional data* and *capital stock*) are correlated with lower reported
1145 Verdoorn coefficients. The present results of this multivariate MRA model explain
1146 half of the total variation. Neither *non-manufacturing*, nor *all sectors* are statistically
1147 significant.

1148 Contrary to the simple MRA in tables 1.1 to 1.5, the static specification seems
1149 to produce statistically significant signs of Verdoorn's law. Nevertheless, the static
1150 specification of the Kaldor-Verdoorn law seems to deliver lower estimates than the
1151 dynamic specification. This is consistent with the rest of the literature and indicates
1152 that the underlying technical progress function might not be based on a Cobb-Douglas
1153 production function after all. If this is the case, however, then combining both dynamic
1154 and static specifications is problematic, as they will not measure the same thing. Thus,
1155 table 1.8 repeats the FAT-PET-PEESE multivariate MRA from table 1.7, but this time
1156 distinguishes between dynamic and static specification.

1157 Similar to table 1.7, no sign of publication bias can be found even at the 10% sig-
1158 nificance level. As was shown before, the dynamic specification reports higher meta-
1159 averages (0.539) than its' static sibling (0.460). Here, the statistical significance of
1160 the models explanatory variables depends on the specification chosen. The dynamic
1161 specification yield five variables with positive influence on the meta-average (*tfi*, *no*
1162 *OECD member*, *nonlinear*, *regional data* and *time series*) and five variables with negative

Table 1.7 – Multiple meta-regression analysis

	(1) FAT-PET	(2) PEESE
single country	-0.240** (0.110)	-0.240** (0.110)
endogeneity	-0.235+ (0.059)	-0.235+ (0.059)
no OECD member	0.204*** (0.067)	0.204*** (0.067)
regional data	0.246** (0.103)	0.246** (0.103)
time series	0.216** (0.100)	0.216** (0.100)
nonlinear	0.235+ (0.056)	0.235+ (0.056)
capital stock	-0.147*** (0.045)	-0.147*** (0.045)
static	-0.270*** (0.092)	-0.270*** (0.092)
Constant	0.597+ (0.076)	0.597+ (0.076)
Adjusted R^2	0.50	0.50
Observations	507	507
Number of studies	49	49
BIC	-41.10	-41.10

* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$, + $p < 0.001$;
standard errors in parentheses.

Table 1.8 – Multiple meta-regression analysis: dynamic vs. static specification

	dynamic		static	
	(1) FAT-PET	(2) PEESE	(3) FAT-PET	(4) PEESE
regional data	0.090*** (0.031)	0.090*** (0.031)	0.734+ (0.008)	0.734+ (0.008)
endogeneity	-0.133*** (0.049)	-0.133*** (0.049)		
fixed effects	-0.099*** (0.029)	-0.099*** (0.029)		
random effects	-0.094+ (0.026)	-0.094+ (0.026)		
single country	-0.097** (0.036)	-0.097** (0.036)	-1.157+ (0.117)	-1.157+ (0.117)
nonlinear	0.253+ (0.045)	0.253+ (0.045)		
capital stock	-0.163*** (0.047)	-0.163*** (0.047)	-0.158** (0.064)	-0.158** (0.064)
time series	0.111*** (0.033)	0.111*** (0.033)	1.242+ (0.261)	1.242+ (0.261)
tfi	0.112*** (0.037)	0.112*** (0.037)		
no OECD member	0.199+ (0.038)	0.199+ (0.038)	0.300*** (0.087)	0.300*** (0.087)
all sectors			-0.374*** (0.116)	-0.374*** (0.116)
unpublished			-0.276** (0.116)	-0.276** (0.116)
Constant	0.539+ (0.029)	0.539+ (0.029)	0.460*** (0.114)	0.460*** (0.114)
Adjusted R^2	0.31	0.31	0.81	0.81
Observations	404	404	103	103
Number of studies	46	46	12	12
BIC	-181.77	-181.77	-61.86	-61.86

* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$, + $p < 0.001$; standard errors in parentheses.

1163 influence (*single country, endogeneity, fixed effects, random effects and capital stock*).
1164 *Single country, endogeneity, regional data and time series* report much lower values
1165 than in table 1.7 when only dynamic specifications are taken into account. Three new
1166 moderator variables seem to be important compared to table 1.7 (*fixed effects, random*
1167 *effects and tfi*), while the meta-average is slightly lower than previously reported. The
1168 static specification in comparison reports a distinctly lower meta-average than in table
1169 1.7, with two new explanatory variables, *all sectors* and *unpublished*. Three variables
1170 are positively correlated (*no OECD member, regional data and time series*), while three
1171 are negatively correlated (*capital stock, all sectors and unpublished*).

1172 Regarding differences in specific sectors, the results for the static version are similar
1173 to the available literature in that there is a statistically significant difference between
1174 manufacturing (due to our choice of dummies this is explicitly our baseline specification)
1175 and estimations that study all sectors together. Verdoorn's law seems to be lower for
1176 all sectors than for manufacturing alone, implying that Verdoorn's law is stronger in
1177 manufacturing than in non-manufacturing sectors. This is expected, as manufacturing
1178 has been presented as the key driver of growth by Kaldor (1966) himself, as well as
1179 much of the following literature. Indeed, most of the empirical literature assumes that *if*
1180 Verdoorn's law existed, it would do so in manufacturing only. The present MRA result
1181 do corroborate this interpretation. If the results are correct, then a manufacturing-based
1182 industrial strategy would lead to higher long-run growth rates than rivalling strategies.

1183 Compared to the dynamic specification, *no OECD member* as well as *time series*
1184 have a slightly bigger impact, while the correlation of *regional data* is much higher
1185 in the static specification. Notwithstanding these differences, in both specifications
1186 we find statistically significant meta-averages in the upper echelon of typical reported
1187 Verdoorn coefficient estimates. Our multivariate MRA model can explain 31% of the

1188 variation for the dynamic specification and 81% for the static specification.

1189 **1.5.2 Robustness Checks**

1190 It has to be made clear that treating each regression as a single entry might introduce
1191 some bias, as papers with several control specifications will be over-represented. How
1192 to tackle this issue is not agreed upon in the economics MRA community (Stanley and
1193 Doucouliagos 2012). Unless stated otherwise, for this study weighted least squares
1194 (WLS) regression with inverse variance weights and cluster-robust standard errors are
1195 used as the main method of correction. Other possibilities include for example the use of
1196 the inverse number of estimates per paper as respective weights, which has been coded
1197 for robustness checks as well. Table 1.9 reports several different alternative estimation
1198 specifications which, following Havránek (2015) and Iamsiraroj and Doucouliagos
1199 (2015), have been used in order to control the robustness of our FAT-PET-PEESE MRAs.

1200 For convenience, column 1 reports the same results as column 1 in table 1.7, which
1201 were derived using a general-to-specific approach. For column 2, the general model
1202 gets estimated, after which we test all variables that are not statistically significant
1203 at the 0.3 level at least. An F-test confirms that the variables chosen this way can be
1204 dropped from the MRA; F-test = 0.81 and p-value = 0.62. The general model then gets
1205 re-estimated without the dropped variables.

1206 Comparing the results from column 2 with column 1, we can see that only two
1207 additional variables are found, however, without being statistically significant even at
1208 the 10% level. Both the meta-average as well as the moderator variables stay virtually
1209 unchanged.

1210 Column 3 uses the same specification than column 1, only this time with the degrees

1211 of freedom as weight rather than the inverse variance. The reason for this is that
1212 reported standard errors might be endogenous to reported point estimates (Havránek
1213 2015). Compared to column 1, the size of the coefficients in general is smaller (with the
1214 exception of *time series*. Also, *no OECD member*, *nonlinear*, and *no capital stock* are not
1215 statistically significant anymore, but a series of other variables (*fixed effects*, *random*
1216 *effects*, *se_i*, *no cycle control*, *all sectors*, *no wages* as well as *tfi*) do appear to have an
1217 influence on the meta-average.

1218 As Stanley and Doucouliagos (2012, p.73) argue, the square root of the number
1219 of observations can serve as a lower-quality proxy of the standard error. Column 4
1220 uses \sqrt{n} instead of *se_i* in our baseline. The results stay the same, with a minimally
1221 higher meta-average. Still, as the number of observations contains less information on
1222 variability factors, *se_i* is preferable to \sqrt{n} .

1223 Column 5 reports the same baseline specification as column 1, but this time with
1224 1 over the number of estimates per study as analytical weights instead of the inverse
1225 variance. This specification seems to be a rather bad proxy of our FAT-PET MRA, as
1226 only two moderator variables (*nonlinear* and *no capital stock*) stay the same while the
1227 rest of the old specification is not significant. Additionally, two variables (*no techn.*
1228 *gap* and *unpublished*) gave a statistically significant effect on the reported Verdoorn
1229 coefficient, which is a bit higher than in the other specifications.

1230 Finally, instead of using elasticities as effect size, the partial correlation can be used.
1231 The partial correlation has the advantage that it renders all estimates comparable with
1232 each other and thus the meta-average can be estimated based on a higher amount of
1233 observations. On the other hand, its interpretation is not straightforward, as partial
1234 correlations have more of a statistical meaning, rather than an economic one. Following
1235 Doucouliagos's (2011) guidelines on interpreting partial correlations, a small economic

1236 effect can be inferred from a partial correlation of 0.07 or higher, a medium one from
1237 0.17 onward and a large one from estimates higher than 0.32. Here, the use of partial
1238 correlation points at a small statistically significant relation between output and produc-
1239 tivity growth - according to the FAT-PET MRA using partial correlations, Verdoorn's
1240 law exists as well. Only three moderator variables stay statistically significant here (*no*
1241 *OECD member*, *single country* and *capital stock*). In conclusion, all robustness checks
1242 indicate that Verdoorn's law is real and the FAT-PET-PEESE MRA results can thus be
1243 considered robust.

1244 **1.5.3 Comparing differing estimation strategies**

1245 As was explained before, due to the lack of sample means it was not possible to transform
1246 the elasticities of the *Rowthorn1* and *Rowthorn2* specifications into the *Kaldor-Verdoorn*
1247 specification. In order to secure the maximum amount of transparency, tables 1.10 and
1248 1.11 presents the multivariate FAT-PET-PEESE MRA for each of the *Verdoorn*, *Kaldor*,
1249 *Rowthorn1* and *Rowthorn2* specifications. Due to multicollinearity issues, *regional data*
1250 had to be dropped for this MRA in order to ensure direct comparability between the
1251 different specifications. All four specifications find a statistically significant Verdoorn
1252 coefficients, even though the overall value of this effect, as well as the important
1253 moderator variables differ severely according to the specification chosen.

1254 Table 1.12 reports the meta-averages from tables 1.7, 1.10 and 1.11, the transformed
1255 meta-averages in terms of the Kaldor-Verdoorn specification and the implied returns
1256 to scale. As was discussed in section 1.2, if the economy is based on a Cobb-Douglas
1257 production function, the degree of macroeconomic returns to scale is given by $\mu = \frac{2}{1+\beta_1}$,
1258 where α and β are the output elasticities of capital and labour.

Table 1.9 – Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)
	FAT-PET	p<0.3	df	\sqrt{n}	$\frac{1}{e}$	r
single country	-0.240** (0.110)	-0.238** (0.110)	-0.166*** (0.049)	-0.247** (0.106)		0.398** (0.153)
endogeneity	-0.235+ (0.059)	-0.236+ (0.059)	-0.165** (0.066)	-0.244+ (0.062)		
no OECD member	0.204*** (0.067)	0.203*** (0.067)		0.192*** (0.069)		0.248** (0.119)
regional data	0.246** (0.103)	0.248** (0.103)	0.163*** (0.055)	0.231** (0.101)		
time series	0.216** (0.100)	0.212** (0.102)	0.313*** (0.095)	0.213** (0.094)		
nonlinear	0.235+ (0.056)	0.235+ (0.056)		0.227+ (0.058)	0.263+ (0.038)	
capital stock	-0.147*** (0.045)	-0.148*** (0.045)		-0.150*** (0.046)	-0.162** (0.062)	-0.107*** (0.038)
static	-0.270*** (0.092)	-0.273*** (0.093)	-0.120* (0.071)	-0.259** (0.098)		
fixed effects		-0.080 (0.059)	-0.118*** (0.038)			
random effects		-0.082 (0.059)	-0.114*** (0.038)			0.274* (0.154)
SE			0.014** (0.007)			
no cycle control			-0.116** (0.054)			
tfi			0.130** (0.053)			
no wages			0.105** (0.040)			
all sectors			0.122*** (0.036)			
non-manufacturing					0.152** (0.064)	
no tech. gap					-0.160** (0.072)	
unpublished						0.154* (0.092)
Constant	0.597+ (0.076)	0.599+ (0.076)	0.417+ (0.063)	0.614+ (0.080)	0.680+ (0.071)	0.142+ (0.021)
Adjusted R ²	0.50	0.50	0.16	0.51	0.09	0.45
Observations	507	507	495	495	507	495
Number of studies	49	49	49	49	49	49
BIC	-41.10	-41.79	-41.87	-44.35	214.70	-167.22

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table 1.10 – Comparison Verdoorn vs. Kaldor specification

	Verdoorn		Kaldor	
	(1) FAT-PET	(2) PEESE	(3) FAT-PET	(4) PEESE
non-manufacturing	0.255+ (0.062)	0.255+ (0.062)		
endogeneity	-0.231+ (0.049)	-0.231+ (0.049)	-0.385+ (0.060)	-0.397+ (0.060)
static	-0.388+ (0.074)	-0.388+ (0.074)	-0.288+ (0.049)	-0.264*** (0.070)
unpublished	-0.123** (0.045)	-0.123** (0.045)		
capital stock	-0.152** (0.069)	-0.152** (0.069)	-0.139+ (0.029)	-0.174+ (0.031)
no tech. gap	-0.226*** (0.074)	-0.226*** (0.074)		
no wages	0.304+ (0.066)	0.304+ (0.066)	-0.125** (0.057)	-0.145** (0.054)
tfi	0.270* (0.145)	0.270* (0.145)	0.144** (0.054)	0.142** (0.052)
single country	0.179*** (0.051)	0.179*** (0.051)	-0.168* (0.084)	
crosssectional	0.284+ (0.055)	0.284+ (0.055)	-0.228** (0.085)	-0.271*** (0.080)
SE			-1.388* (0.800)	
time series			0.094** (0.039)	
all sectors			0.285*** (0.080)	0.392+ (0.094)
no OECD member			0.258*** (0.082)	0.324+ (0.061)
fixed effects				-0.147*** (0.050)
random effects				-0.141*** (0.047)
Constant	0.441+ (0.090)	0.441+ (0.090)	0.869+ (0.131)	0.702+ (0.061)
Adjusted R ²	0.63	0.63	0.69	0.67
Observations	244	244	263	263
Number of studies	32	32	32	21
BIC	-118.06	-118.06	-83.87	-80.46

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table 1.11 – Comparison Rowthorn 1 vs Rowthorn 2 specification

	Rowthorn 1		Rowthorn 2	
	(1) FAT-PET	(2) PEESE	(3) FAT-PET	(4) PEESE
non-manufacturing	-1.225+ (0.116)	-1.225+ (0.116)		
tfi	0.638+ (0.020)	0.638+ (0.020)		
all sectors	0.189* (0.092)	0.189* (0.092)	0.506+ (0.111)	0.506+ (0.111)
capital stock	0.238** (0.068)	0.238** (0.068)	-0.394+ (0.079)	-0.394+ (0.079)
no tech. gap	0.204+ (0.033)	0.204+ (0.033)		
no OECD member	0.236+ (0.030)	0.236+ (0.030)		
single country	0.116* (0.058)	0.116* (0.058)	0.596+ (0.069)	0.596+ (0.069)
endogeneity			-0.094** (0.042)	-0.094** (0.042)
static			-0.238** (0.086)	-0.238** (0.086)
no cycle control			-0.184*** (0.058)	-0.184*** (0.058)
Constant	-0.254*** (0.063)	-0.254*** (0.063)	0.770+ (0.051)	0.770+ (0.051)
Adjusted R^2	0.84	0.84	0.68	0.68
Observations	34	34	124	124
Number of studies	7	7	14	14
BIC	-4.51	-4.51	-81.60	-81.60

* $p < 0.1$ ** $p < 0.05$, *** $p < 0.01$, + $p < 0.001$; standard errors in parentheses.

Table 1.12 – Reported meta-averages, transformed to Verdoorn specification and corresponding returns to scale

Specification	Kaldor-Verdoorn	Verdoorn	Kaldor	Rowthorn1	Rowthorn2
simple unweighted average	0.50	0.54	0.53	-0.02	0.73
simple unweighted average, transformed to Verdoorn specification	0.50	0.54	0.47	51	0.43
meta-average by specification	0.60	0.44	0.31	-0.25	0.77
meta-average, transformed to Verdoorn specification	0.60	0.44	0.69	5.00	0.44
returns to scale	1.25	1.39	1.18	0.33	1.39
number of Observations	507	244	263	34	124

1259 Based on our sample from 49, 7 and 14 studies respectively, we now compare the
1260 different specifications. These specifications however are not equal to each other, but
1261 imply very different views regarding the nature of the economic problem. While the
1262 *Kaldor* specification emphasises the role of aggregate demand for economic growth,
1263 both the *Rowthorn1* and *Rowthorn2* specifications imply an economy under supply-side
1264 constraints. In term of meta-averages by specification, the *Kaldor-Verdoorn* specification
1265 finds a Verdoorn coefficient of 0.60 (compared to the unweighted average of 0.50),
1266 the Verdoorn specification yields a Verdoorn coefficient of 0.44 (compared to the un-
1267 weighted average of 0.54), the *Kaldor* specification finds a Verdoorn coefficient of 0.69
1268 (compared to the unweighted average of 0.47 transformed to the Verdoorn specifica-
1269 tion) the *Rowthorn1* specification yields a Verdoorn coefficient of 5.00 (compared to
1270 the unweighted average of 51 transformed) and the *Rowthorn2* specification finds a
1271 Verdoorn coefficient of 0.44 (compared to the unweighted average of 0.43 transformed).
1272 When we then calculate the returns to scale, the *Kaldor-Verdoorn* specification experi-
1273 ences strong increasing returns to scale of 1.25, the Verdoorn specifications implies
1274 returns to scale of 1.39, while the *Kaldor* specification yields returns to scale of 1.18.
1275 The *Rowthorn1* and *Rowthorn2* specifications imply very different returns to scale (0.33

and 1.39 respectively), although in the case of the *Rowthorn1* specification, the results could be challenged on the basis of a very low number of overall observations (34). Because of the low number of observations and the fact that *Rowthorn1* meta-average results are extremely different from the rest, we will exclude it in continuation when providing a possible range of the Verdoorn effect. Nevertheless, all other specifications imply increasing returns to scale. These differences in results show that the choice of specification matters. The resulting Verdoorn coefficient, and the implied returns to scale vary significantly according to the specification chosen.

1.6 Conclusion

Our study summarises the plethora of empirical estimates surrounding Verdoorn's law, the relation between growth in aggregate output/demand and productivity growth. Conventional literature reviews are very limited, in both the amount of pages dedicated to such an enterprise, as well as the level of detail they can delve into. Using a method known as Meta-regression analysis (MRA), 665 estimates of 52 studies in a newly created data set along with several study-specific properties were gathered and analysed FAT-PET-PEESE MRA using weighted least square (WLS) regression.

Four main findings can be drawn from this study. First, nearly none of the commonly used estimation specifications show signs of publications bias, even taking into account various control specifications. This is unusual, as most MRA studies find existing publication selection bias in the studied fields.

Secondly, the high statistical significance of a meta-average hints at the presence of a genuine underlying effect linking both output/demand growth and productivity growth. We find a statistically significant meta-average across all specifications. Verdoorn's law

1299 is real and ranges between 0.44 and 0.69, implying returns to scale between 1.18 and
1300 1.39. As a result, the range of Verdoorn's law found in this meta-regression analysis
1301 exceed the range given by McCombie, Pugno, and Soro (2002) (0.30 to 0.6). This might
1302 have important implications for many different fields of research, such as economic
1303 development, trade and growth theory. As such, Verdoorn's law provides a powerful
1304 element in an alternative to the secular stagnation narrative (Hansen 1938; Gordon
1305 2015), where reasons for long-term slow economic growth are usually only found using
1306 supply-side arguments. The existence of an effect as reported by Verdoorn (1949) might
1307 hint at the importance of demand-side explanations and possible solutions (Storm
1308 2017). But even when the existence of this effect is acknowledged, its interpretation as
1309 well as its relation to supply- or demand-side arguments is different according to the
1310 specification chosen.

1311 Thirdly, the choice of estimation specification matters. The overall effect differs
1312 strongly depending on the used specification, even more so than indicated by the overall
1313 literature. While most specifications find strong Verdoorn coefficients with increasing
1314 returns to scale, Rowthorn's first specification finds coefficients implying decreasing
1315 returns to scale.

1316 Fourth, in not a single specification was the Verdoorn coefficient higher in non-
1317 manufacturing sectors than in manufacturing. Most of the time, our FAT-PET-PEESE
1318 MRA failed to find significant differences between manufacturing and non-manufacturing
1319 at all. We cannot determine whether the *non-manufacturing* and *all sectors* dummies
1320 where not significant because there was no difference in size between manufacturing
1321 and non-manufacturing or whether there simply is no effect in other sectors than
1322 manufacturing. The fact that the Verdoorn effect was at least higher in manufacturing
1323 than anywhere else is an expected result for Kaldorians. Kaldorians use to see the

1324 manufacturing sector as 'the engine of growth'. According to them, manufacturing
1325 may drive growth in the sense that it creates employment and business opportunities
1326 for entrepreneurs.

1327 As this study tried to show using a new data set, contradictory results can be found
1328 according to the type of specification that is preferred. Specifications of this type are
1329 being used based on probably unsolvable differences regarding the kind of assumptions
1330 about contemporary capitalism we believe to be real. The results show that the estimates
1331 are very sensitive with regards to the level of aggregation, the estimation specification,
1332 as well as the control for endogeneity. Similarly, it should be seen as a call for other
1333 researchers to include fundamental test statistics in their published regression outputs,
1334 so that it can give rise to an increase in the use of meta-regression analysis in economics
1335 in general.

1336 In this chapter, we have given an ample overview of the available literature on
1337 Verdoorn's law. We discussed its' history, the theoretical debates surrounding its work-
1338 ing as well as the differences in interpretation depending on whether one sees the
1339 economy to be ultimately supply-constrained or demand-constrained. We further dis-
1340 cussed additional control variables that need to be taken into account when conducting
1341 proper research on Verdoorn's law as well as the 'static-dynamic' paradox. As main
1342 contribution to the available literature, in the former chapter we've undertaken a meta-
1343 regression analysis on the primary literature regarding Verdoorn's law. Using a novel
1344 data set, we find no signs of publication bias, but we do find statistically significant
1345 meta-averages across all specifications.

1346 Looking at the insights provided by the present chapter we can safely say that the
1347 model part that describes Verdoorn's law in figure 5 is correct. Figure 1.6a therefore
1348 presents the same model again, this time with a broad, green border around round

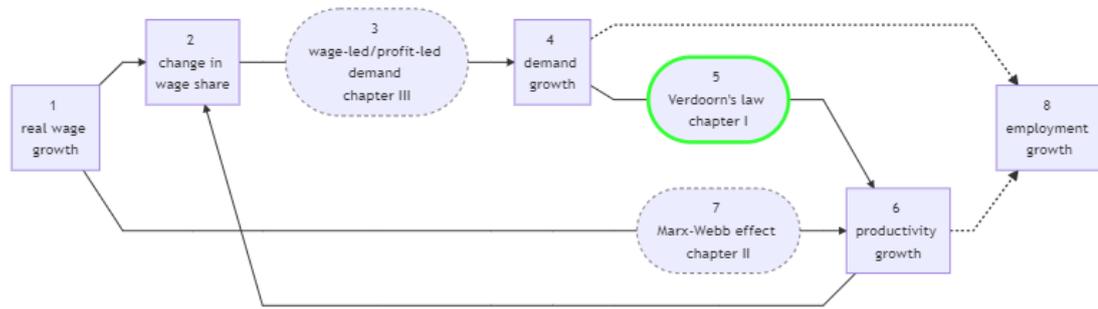


Figure 1.5 – The distribution-productivity-employment nexus, part I:

(a) Based on the present meta-regression analysis, Verdoorn's law is found to be real, with the Verdoorn effect ranging between 0.30 and 0.68.

1349 box number 5. Based on the present meta-regression analysis, Verdoorn's law is found
 1350 to be real, with the Verdoorn effect ranging between 0.44 and 0.69. With chapter
 1351 I, we have thus established Verdoorn's law as an economic mechanism which links
 1352 output/demand growth (box 4) to productivity growth (box 6). The next step consists
 1353 in trying to establish such a link between real wage growth (box 1) and productivity
 1354 growth via the Marx-Webb effect in chapter II.

Part II

1355

1356 **Testing Verdoorns Law - A panel data**
1357 **analysis under cross-sectional**
1358 **dependence for 23 EU member**
1359 **countries**

Chapter 2

1360

1361 Testing Verdoorn's law on 23 EU 1362 member countries

1363 **2.1 Introduction**

1364 From 2000 onward, the OECD member countries experienced much lower rates than
1365 before, especially when compared to the period of 1970-1980 and as can be seen in
1366 Figure 2.1.

1367 While some countries were able to sustain their relatively higher growth rates for a
1368 bit longer, the great recession of 2007-2008 was a game-changer for all countries. Since
1369 then, OECD member states have not been able to return to pre-crisis growth rates.
1370 For some economists, especially in mainstream economics, this represents not just a
1371 short-run deviation from the respective countries' long-run growth path. Rather, for
1372 them the post-crisis world is one where the growth path itself changed. Low growth
1373 rates are not seen as signs of the economic cycle's longer downturn. Low growth has
1374 come to stay. As is often the case with grand ideas in economics, both good and bad,

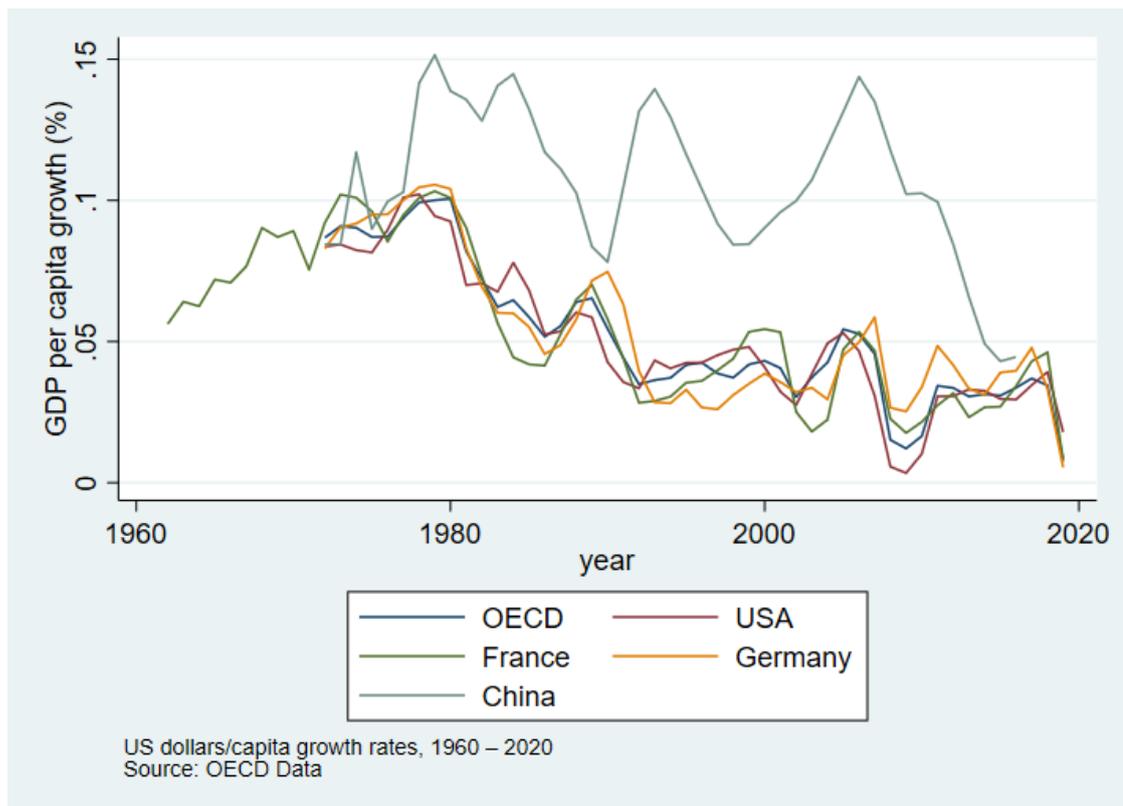


Figure 2.1 – GDP Growth Rates - 3-year moving average

1375 this idea is not novel but rather a based on an 'academic scribbler of a few decades
1376 back'(Keynes 1936). The idea of a grim future, paved with sustained low growth rates
1377 was first expressed as 'secular stagnation' by Alvin Hansen back in the 1930s. Hansen
1378 (1938) created this concept in midst of the Great Depression, the longest and deepest
1379 crisis in capitalism's history up to date.

1380 Hansen, influenced by the ideas of John Maynard Keynes (1936), argued that first,
1381 the post-Great Depression US economy was only stabilised by public spending. In his
1382 view, the downturn of 1937 was a 'double-dip recession'. By this term we understand
1383 an unwillingly created type of economic crisis which is triggered by political pressures
1384 to reduce state activities in the economy, thereby reducing aggregate demand. Second,
1385 Hansen (1938) argued that (by then) contemporary US capitalism's innovations became
1386 less and less innovative. Here, Hansen's main argument was that innovations had
1387 changed from being capital-using, thus creating new and higher demand for investment
1388 to capital-saving, and consequently reducing the overall investments needed for eco-
1389 nomic activity to diminish. In order to promote higher growth rates and end economic
1390 misery, Hansen (1938) therefore argued in favour of demand-led expansionary policies.
1391 This could mean either increasing public consumption or creating permanent public
1392 investment programs instead of just stimulating private investment (Roubtsova 2016).

1393 This chapter seeks to estimate Verdoorn's law using data for 23 EU member countries
1394 for the period 1995-2017. The value hereby added lies in the fact that for the first time
1395 we estimate Verdoorn's law using the EU-KLEMS data-set, which enables us to compare
1396 all 23 members on a sectoral level, with a much higher number of observations. To our
1397 knowledge, this is the first time the EU-KLEMS data set is used in order to estimate
1398 Verdoorn's law. Our findings show that again, the resulting Verdoorn coefficients vary
1399 strongly according to the country group and the estimation specification chosen. Both

1400 estimations of Verdoorn's law specified in growth rates and logarithms consistently
1401 find statistically significant Verdoorn coefficients across all specifications. This is
1402 in contrast to the 'static-dynamic paradox' which is well-discussed in the available
1403 literature(McCombie, Pugno, and Soro 2002). The structure of this chapter is as follows.
1404 Section 2.3 provides a review of empirical literature regarding the fall in productivity
1405 growth. Section 2.4 explains the use of Verdoorn's law in this study to estimate the
1406 effect of changes in aggregate output/demand growth on productivity growth. We
1407 present the data set and the measures taken to obtain robust results in section 2.5.
1408 Section 2.6 presents the econometric results and section 2.7 concludes.

1409 **2.2 Introducing The Productivity Regime**

1410 The Goodwinian line of thinking about the intersection of demand, productivity and
1411 employment regimes was at the centre of a group called the 'Social Structures of
1412 Accumulation' (SSA) school. The SSA school shared several arguments with the French
1413 Regulation School, especially when trying to explain the long-term decline in growth
1414 rates and high inflation in rich countries. The result of this intellectual joint-venture
1415 can be seen in collaborations between its leading members, such as Bowles and Boyer
1416 (2015).

1417 Here, a wage-led policy might lead to a rise in demand and productivity growth.
1418 The rise in productivity itself will lead, however, to a decrease in employment, i.e.
1419 demand and productivity would be wage-led, while employment is profit-led (Boyer
1420 and Petit 1981; Boyer and Petit 1988). In this thesis, we will focus on the relation
1421 between the demand regime and the productivity regime, while only briefly mentioning
1422 the employment regime.

1423 Storm and Naastepad (2013)¹ offer a very interesting way to look at the interactions
 1424 between wages and demand on one side, and technological advancement on the other
 1425 hand. Here, changes in demand can have long-lasting effects on economic growth. The
 1426 authors however include a function for employment growth in their model, pointing at
 1427 potentially concerning effects for the distribution of higher wages amongst workers.
 1428 Finally, their conclusions indicate that, while during most of the twentieth century the
 1429 introduction of new machinery induced a 'hollowing out' of the middle class and a
 1430 polarisation of incomes, there is a return to the use of machinery as was the case during
 1431 the nineteenth century: to the substitution for skilled labour through the simplification
 1432 of tasks.

1433 The model builds on the following three growth equations.

$$\dot{y} = y_0 + y_q \dot{q} + y_w \dot{w} \quad (\text{Labour Productivity}) \quad (1)$$

$$\dot{q} = \tau_0 + \tau_1 [\dot{w} - \dot{y}] \quad (\text{Demand}) \quad (2)$$

$$\dot{e} = \dot{q} - \dot{y} \quad (\text{Employment}) \quad (3)$$

1434 Verdoorn effect describes the Verdoorn effect: higher demand gives incentives to
 1435 increase productivity growth. Marx-Webb effect stands for 'Marx-biased technological
 1436 change' or the 'Marx-Webb effect' (Hein and Tarassow 2010; Lavoie 2017b) - an increase
 1437 in the growth rate of wages \dot{w} gives capitalists incentives to obtain labour-saving

¹Several other publications deserve to be mentioned here, amongst them Setterfield and Cornwall (2002), Naastepad (2006), Hein and Tarassow (2010), Hein (2014) and Lavoie (2014). All of them endogenise technical change via the use of either Verdoorn's law or the Marx-Webb effect, all of them differentiate between a demand regime and a productivity regime, even if there are some smaller differences. Because of this, the work by Storm and Naastepad (2013) will be explained in a notation used by Lavoie (2014), with additions by both Lavoie (2014) and Hein (2014).

1438 technology, thereby increasing productivity. Lavoie (2017a) calls this effect the 'Marx-
 1439 Webb effect'. This is a bit misleading, since the Webb effect is based on the effect of
 1440 higher wages on workers' motivation - very similar to the 'efficiency wage' argument
 1441 (Krassoi Peach and Stanley 2009). While the mechanisms between the Marx-Webb
 1442 effect and the Webb effect are different, both effects assume a positive relation between
 1443 real wage growth real wage growth and productivity growth. For this reason, in this
 1444 thesis we use the term 'Marx-Webb effect' to explain the effect of an increase in wages
 1445 on productivity.

1446 demand regime depicts the actual demand-regime and is positive in a wage-led and
 1447 negative in a profit-led case. $[\dot{w} - \dot{y}]$ describes unit labour cost growth.

$$(1) \rightarrow (3) : \dot{e} = (1 - y_q)\dot{q} - y_0 - y_w\dot{w} \quad (4)$$

1448 Equilibrium growth rates are thus given by

$$\Rightarrow \dot{q} = \frac{\tau_0 - y_0\tau_1 + (1 - y_w)\tau_1\dot{w}}{1 + y_q\tau_1} = \tau_0 + \Xi\dot{w} \quad (5)$$

$$\dot{y} = y_0 + y_q\tau_0 + (y_w + y_q\Xi)\dot{w} \quad (6)$$

$$\dot{e} = -y_0 + (1 - y_q)\tau_0 + [(1 - y_q)\Xi - y_w]\dot{w} \quad (7)$$

(2.1)

1449 The effect of a reduction in wage growth is explained by

$$\frac{\partial \dot{q}}{\partial \dot{w}} = \frac{(1 - y_w)\tau_1}{1 + y_q\tau_1} = \Xi. \quad (8)$$

1450 With y_q and y_w being positive and y_w being smaller than 1², the overall effect
 1451 depends on τ_1 , i.e. the overall demand-regime. Given that the stability condition
 1452 $1 + y_q\tau_1 > 0$ holds, the introduction of endogenous changes in productivity don't
 1453 change the overall nature of the demand-regime for $0 < y_w < 1$. However the overall
 1454 effect of the regime weakens in both cases the more y_w approaches a value of 1.

$$\lim_{y_w \rightarrow 1} \frac{\partial \dot{q}}{\partial \dot{w}} = \lim_{y_w \rightarrow 1} \frac{(1 - y_w)\tau_1}{1 + y_q\tau_1} = 0$$

1455 This means that the standard Neo-Kaleckian model is overestimating the effect of a
 1456 change in wages on overall growth of output. The reason for this is as follows.

- 1457 1. Given a wage-led demand regime, an increase in wage growth increases the wage
 1458 share wage share, thus increasing effective demand and output growth, following
 1459 the canonical Neo-Kaleckian model.
- 1460 2. The increase in aggregate demand fuels productivity growth, thus increasing
 1461 the profit share and thus reducing the initial gains obtained via the rise in wage
 1462 growth.
- 1463 3. Finally, the increase in wages also has direct effect on productivity since with
 1464 higher wages it becomes more interesting for capitalists to use labour-saving
 1465 technology, thus reducing the gains from wage-led growth again.

²Storm and Naastepad (2013) give empirical evidence that this is generally the case.

1466 The effect of a change in wage growth on productivity growth can be split into a
 1467 direct effect caused by the change in wages and the indirect effect of changes in effective
 1468 demand. We can see from the following equation that changes in wage growth affect
 1469 productivity more dramatically than output.

$$\begin{aligned} \frac{\partial \dot{y}}{\partial \dot{w}} &= y_w \Delta \dot{w} + y_q \frac{\partial \dot{q}}{\partial \dot{w}} & (9) \\ \Rightarrow \frac{\partial \dot{y}}{\partial \dot{w}} &> \frac{\partial \dot{q}}{\partial \dot{w}}, \quad \forall y_w > 0 \end{aligned}$$

1470 This last point means that higher wage growth reduces employment growth as
 1471 shown in equation (3). Conversely, lower wage growth implies higher employment
 1472 growth, even though output growth can still vary depending on the demand-regime.

$$\begin{aligned} \frac{\partial \dot{e}}{\partial \dot{w}} &= \frac{\partial \dot{q}}{\partial \dot{w}} - \frac{\partial \dot{y}}{\partial \dot{w}} \\ \Rightarrow \frac{\partial \dot{e}}{\partial \dot{w}} &= (1 - y_q) \frac{\partial \dot{q}}{\partial \dot{w}} - y_w \\ \Rightarrow \frac{\partial \dot{e}}{\partial \dot{w}} &= \frac{(1 - y_q - y_w) \tau_1 - y_w}{1 + y_q \tau_1} & (10) \end{aligned}$$

1473 Again, the overall effect of a change in wages on employment can be split in one
 1474 direct and two indirect effects.

- 1475 1. Given a wage-led demand regime, an increase in wage growth increases effective
 1476 demand and thus employment, following the canonical Neo-Kaleckian model.
- 1477 2. The increase in aggregate demand fuels productivity growth, thus putting nega-
 1478 tive pressure on employment as explained by Verdoorn's law.

1479 3. Thirdly, via the Marx-biased technological change channel the increase in wages
1480 is also fueling productivity growth, thereby decreasing employment as well.

1481 Which of these two channels dominates is not clear *a priori*. If $\tau_1 > \frac{y_w}{1 - y_q - y_w}$,
1482 then the overall effect of an increase in wages on employment is always positive. In a
1483 world with exogenous technological change, this is always the case under a wage-led
1484 regime.

1485 Storm and Naastepad (2013) continue by giving estimations as to how big τ_1 would
1486 have to be in order to enable a successful long-term wage-term strategy. In order for
1487 an increase in wages to affect employment positive, equation (10) has to be positive.
1488 Given that the stability condition $1 + y_q \tau_1 > 0$ holds, equation (10) can only be positive
1489 if $(1 - y_q - y_w)\tau_1 - y_w > 0$. It is then possible to obtain the necessary size of τ_1 in order
1490 to empower a successful wage-led policy.

$$\begin{aligned} (1 - y_q - y_w)\tau_1 - y_w &> 0 \\ \Leftrightarrow \tau_1 &> \frac{y_w}{1 - y_q - y_w} \end{aligned} \quad (11)$$

1491 The authors then estimate y_q and y_w , concluding that it is reasonable to assume
1492 coefficients of $y_q = 0.38$ and $y_w = 0.46$ respectively. Given those estimates, one would
1493 need coefficients of $\tau_1 > 2.37$ to fulfil these criteria, something 'totally unrealistic'
1494 according to Lavoie (2014, p. 434). Storm and Naastepad (2013) conclude that with the
1495 introduction of technological change, cooperative capitalism's big dilemma becomes
1496 clear: Wage-led-oriented policies might be able to boost economic growth and increase
1497 productivity. But it is exactly those increases in productivity that put pressure on
1498 employment, thereby making it impossible to let everybody obtain the gains without

1499 reducing the overall amount of hours worked.

1500 Storm and Naastepad (2013), by using the literature on Verdoorn's law and the Marx-
1501 Webb effect try to combine two different approaches to post-Keynesian endogenous
1502 growth with its effects on long-term employment. If there is any consensus amongst
1503 the different Keynesian schools that can be agreed upon, it might very well be the
1504 notion that an equilibrium in both the goods market and the money market might not
1505 yet imply full employment. Indeed, there usually might (and will) exist involuntary
1506 unemployment. Yet even if this seems to be one of the most fundamental claims of any
1507 Keynesian approach, it is interesting that most post-Keynesian long-run analysis do
1508 not offer a special employment function. Usually in neo-Kaleckian models, the rate
1509 of capacity utilisation is used as both a proxy for aggregate demand and employment.
1510 However this is not enough to explain long-term trends in employment. Some post-
1511 Keynesians like Stockhammer (2008) use an endogenous NAIRU to explain long-term
1512 employment growth, but this has not proven to become a consensual view in post-
1513 Keynesian theory. Storm and Naastepad (2013) offer a different way in that they explain
1514 growth in employment as the difference between demand and productivity growth,
1515 which enables them to look deeper into the overall effect of technological change. There
1516 are however some open questions to answer, which shall be presented in the following.

1517 As Hein (2014) points out, the authors seem to implicitly assume that wages increase
1518 faster than productivity to have any effect similar to the one described by the 'Marx-
1519 biased technological change' literature, which does not necessarily always have to be
1520 the case. It might thus be helpful to look into the other two possible cases – productivity
1521 growth being higher than wage growth and the two being equal. Another critique
1522 concerns the nature of the aggregate demand growth/capital accumulation function
1523 used by Storm and Naastepad (2013). As Hein and Tarassow (2010, p. 729) argue,

1524 in Storm and Naastepad 2013's model with an exogenous growth in real wages, '[...]
 1525 *productivity growth only feeds back on output growth through its effects on the profit share,*
 1526 *but has no direct effect on investment*'. Thus, one should consider adding productivity
 1527 growth directly into the capital accumulation function, while exchanging real wage
 1528 growth for the wage/profit share. Lavoie (2014) gives another reasoning for adding
 1529 productivity growth directly into the demand growth/capital accumulation function
 1530 via referring to the Schumpeterian argument that productivity growth '[...] *should be*
 1531 *included in the investment function and hence in the equation determining output growth*'
 1532 (Lavoie 2014, p.435). He then continues modifying equations (1) and (2) as explained, but
 1533 instead of replacing real wage growth \dot{w} with the wage/profit share uses the difference
 1534 between real wage growth \dot{w} and productivity growth \dot{y} .

$$\dot{y} = y_0 + y_q \dot{q} + y_w (\dot{w} - \dot{y}) \quad (\text{Labour Productivity}) (1')$$

$$\dot{q} = \tau_0 + \tau_1 (\dot{w} - \dot{y}) + \tau_2 \dot{y} \quad (\text{Demand}) (2')$$

1535 By assuming a coefficient of 0.2 for τ_2 , Lavoie obtains values for a necessary τ_1
 1536 of around 0.65, showing that the direct inclusion of labour-saving technology in the
 1537 capital accumulation equation yields less harsh results for wage-led policies than in the
 1538 original model by Naastepad and Storm (2010).

1539 The Bhadhuri-Marglin model has been tested countless times in the past decades.
 1540 Similarly there exists a growing literature of empirical studies concerning technological
 1541 change in the post-Keynesian literature. The biggest part of those studies focus on the
 1542 Verdoorn effect and its coefficient in different countries. McCombie, Pugno, and Soro
 1543 (2002) offer a detailed survey of more than 80 studies concerning the Verdoorn effect,

1544 from the original study by Verdoorn (1949) until 2001. They show that the Verdoorn
1545 effect has been confirmed in the overwhelming majority of these studies with different
1546 methods and data, with an average coefficient between 0.64 and 0.67. This is true for
1547 cross-section estimations for countries or regions (US, UK and countries of the European
1548 Union, among others), or for industry branches (US, UK, France and Germany, among
1549 others), but also for time series econometrics for single countries or regions (US, UK
1550 and Germany, among others).

1551 Marquetti (2004) tests the relationship between wages and productivity in a very
1552 detailed manner. Starting from one of Kaldor's 'stylised facts', the constancy of the
1553 wage and the profit shares, Marquetti (2004) tests both variables for co-integration,
1554 using a data set ranging from 1869-1999 which was already used before by Duménil
1555 and Lévy (1995). The author further uses a two-step procedure suggested by Engle
1556 and Granger (1987) indicating that wage growth Granger-causes productivity growth,
1557 but not the other way around. Thus, he concludes, wages and productivity have a
1558 long-lasting relationship. He further explains the possible reason for this as follows:
1559 *'In this framework, an increase in real wages intensifies the search for and adoption of*
1560 *labor-saving technical change. On the other hand, a decline in the growth rate of real wages*
1561 *reduces the incentives to search for and adopt technical innovation, causing a slowing in*
1562 *the growth rate of labor productivity'* (Marquetti 2004, p. 434). This relationship seems
1563 to be of one-to-one and is consistent with Kaldor's 'stylised fact'.

1564 Starting from the stylised fact that GDP growth in the Anglo-Saxon countries was
1565 smaller than in Europe during the 1960s until the 1990s, even though the latter had
1566 'more rigid labour markets', Vergeer and Kleinknecht (2007) use panel-data regression
1567 of 19 OECD countries from 1960 to 2004 to estimate both the effects of aggregate
1568 demand and real wage growth on productivity growth, using the 'Total Economy

1569 Database (May 2006) of the Groningen Growth and Development Centre' The dependent
1570 variable is growth in value added per labour hour while the key independent variable is
1571 annual percentage growth of the real wage. Other control variables include the relative
1572 difference between the labour productivity level of a country and that of the country
1573 with the highest level of labour productivity in the sample, past labour productivity,
1574 country as well as year dummies and service sector shares in total value added, following
1575 the Baumol argument that technological gains in the service sector are smaller than in
1576 the manufacturing sector. The authors find that

1577 *Apart from the inclusion of GDP growth in the year when labour productivity*
1578 *growth was measured (the most frequent specification in the literature), sig-*
1579 *nificance tests showed that GDP growth with a one-year lag should also be*
1580 *included. The immediate effect of this Verdoorn coefficient is 0.55 while the*
1581 *long-run effect (including the higher order effects through the lagged Verdoorn*
1582 *coefficient and the lags of labour productivity growth) equals 0.25*

1583 .

1584 The estimated Marx-Webb effect lies between 0.24 and 0.34. Hein and Tarassow
1585 (2010) follow Vergeer and Kleinknecht (2007) in their methodology with the aid of an
1586 error-correction-model (
1587 acrsshortecm), but replace real wage growth as the variable describing the wage push
1588 explanation by the profit share. Using the database of the Annual macro-economic
1589 database of the European Commission's Directorate General for Economic and Financial
1590 Affairs (AMECO) which covers a time frame from 1960 to 2007, the authors estimate
1591 the growth of real output per person employed (full-time equivalents). Explanatory
1592 variables include real wage growth in a first round, followed by the change in the

1593 profit share in a second. Other variables are the share of manufacturing output in total
1594 GDP and catching up processes with the technology leader, similar to Vergeer and
1595 Kleinknecht (2007). The results coincide with most of the studies mentioned before. The
1596 strongest influences of output growth on productivity growth were found for France
1597 (0.54%) and the lowest for the US (0.11%), while the wage push coefficient experienced
1598 the strongest increase in Austria (0.67%), and showing the lowest value in the UK (0.25%).
1599 However, in the first time sub-group several European countries experience significant
1600 positive correlation between a rise in the profit share and productivity growth. One
1601 possible explanation for this phenomenon might be non-linearities in the relationship
1602 between wage growth and productivity growth.

1603 As Lavoie (2014) points out however, one has to treat the empirical results concerning
1604 the Verdoorn effect on productivity with great care. Kaldor's version of Verdoorn's law
1605 shows no difference to neither the dynamic version of the Cobb-Douglas production
1606 function nor the dynamic version of the national accounts. This could mean that
1607 in the end the Verdoorn effect might not be anything else than a statistical artefact,
1608 especially since all too often the coefficients share an uncomfortable similarity with
1609 the wage/profit shares (Lavoie 2014, p.429).

1610 **2.3 Wages and Productivity: Empirical Studies**

1611 Studies dealing with the fall in productivity are not new. Especially in recent years,
1612 some studies have attempted to analyse this decay using micro-econometric methods
1613 (Autor et al. 2017; Böckerman and Maliranta 2012; IMF 2017). Most of these studies
1614 link the fall in the wage share to changes in productivity or the terms of trade and to
1615 rigidities in access to financial markets. Another group of studies explains the fall in

1616 productivity by a sub-optimal allocation of foreign excess capital and models these
1617 relationships with so-called credit friction models (Benigno and Fornaro 2014; Grjebine,
1618 Héricourt, and Tripier 2019; Piton 2019; Reis 2013). The inflow of foreign capital thus
1619 finances the less productive firms in the non-tradeable goods sector instead of the
1620 more productive ones, the result being a decline in average productivity. In the case of
1621 Portugal, Reis (2013) concludes that a further opening of the financial market without
1622 financial deepening can thus have counter-intuitive effects.

1623 However, we are interested in analysing the sectoral dynamics between the wage
1624 share productivity from a macroeconomic perspective, which may have completely
1625 different effects than at the purely corporate level. Productivity changes cannot be
1626 explained solely by miss-allocation of capital from abroad, but must rather be understood
1627 as a link between employment and the distribution of wages and profits.

1628 Taylor and Ömer (2019a) use a self-constructed database to conduct a meso-economic
1629 analysis of 16 sectors of the US economy, examining employment, productivity levels
1630 and growth rates, real wage growth rates and inter-sectoral terms of trade between
1631 1990 and 2016. The authors conclude that the 16 sectors can be divided into a group
1632 of seven 'stagnant' sectors with little or no wage and productivity growth but high
1633 employment growth. At the same time, there are nine 'dynamic' sectors with high rates
1634 of productivity growth in wages but deteriorating employment and sectoral terms of
1635 trade. Similarly, Taylor and Ömer (2019b) use growth decompositions for the same
1636 period and the same sectors to show that employment reacts positively to increases
1637 in output and negatively to increases in productivity over the period observed. The
1638 authors also show that the change in employment away from dynamic to stagnant
1639 sectors explains the general decline in the US wage share.

1640 The database we use (EU-KLEMS) can only cover the period from 1995 to 2017, with

1641 a few countries only providing observations over a smaller sub-period. At the same
1642 time, the ones available to us allow a more detailed analysis covering 19 sectors instead
1643 of the 16 sectors of Taylor and Ömer (2019a) and Taylor and Ömer (2019b).

1644 Grjebine, Héricourt, and Tripier (2019) use the Total Factor Productivity (TFP)
1645 database of the EU KLEMS database and show, using Germany, France and Spain as
1646 examples, a divergence in the European Monetary Union (EMU) between the "core
1647 countries" with high productivity growth and the "peripheral countries" with low
1648 productivity growth. While property prices in Germany fell between 2000 and 2008,
1649 the experience in Spain and France was contrary, as both countries experienced a
1650 property boom. While prices in Spain fell sharply with the outbreak of the financial
1651 crisis, they fell only very slightly in France. According to Grjebine, Héricourt, and
1652 Tripier (2019), sectoral re-allocations are at the centre of this divergence. They argue
1653 that the divergence in property prices between core and periphery can explain most
1654 of these sectoral re-allocations, not only in construction but in every sector of the
1655 economy. Grjebine, Héricourt, and Tripier (2019) examine how changes in the value of
1656 real estate assets affect investment, total factor productivity and gross value added at
1657 the level of individual countries and sectors through a coverage mechanism. If capital
1658 markets are imperfect, companies in financially distressed sectors will start to use
1659 the real estate they own as garnish-able assets as collateral. As property prices rise,
1660 the value of these securities will also increase and therefore companies in this sector
1661 can benefit from additional funding. The results of Grjebine, Héricourt, and Tripier
1662 (2019) suggest that the rise in real estate prices correlates with higher investment and
1663 a higher sectoral share in value added, but not with total factor productivity. The
1664 authors therefore conclude that property shocks do not have a significant impact on
1665 total factor productivity at the sectoral level, but rather affect total productivity through

1666 the redistribution of resources between sectors (Grjebine, Héricourt, and Tripier 2019,
1667 p.8).

1668 Our own analysis differs in that we use 23 of the former EU28 members rather than
1669 just Germany, France and Spain. We hope that this broader selection will enable us to
1670 make a more detailed analysis of the underlying macroeconomic dynamics. Second,
1671 while Grjebine, Héricourt, and Tripier (2019, p.3) argue that 'it is widely recognised
1672 that the dynamics of total factor productivity drive long-term economic growth (and
1673 thus GDP per capita)', there are a significant number of researchers who criticise the
1674 use of total factor productivity as a purely artificial construct with no clear link to
1675 reality. Even if total factor productivity is more than a residual of a Cobb-Douglas
1676 production function, it cannot measure productivity but can only reflect a weighted
1677 average of the growth rates of wages and profits (Shaikh 1974; Felipe and McCombie
1678 2003; Carter 2011; Felipe and McCombie 2013). To avoid these debates, which go back
1679 to the so-called Cambridge Capital Controversies, our analysis differs from Grjebine,
1680 Héricourt, and Tripier (2019) in that it uses GDP per worker and GPD per hour as
1681 measures of productivity instead of total factor productivity.

1682 Mendieta-Muñoz, Rada, and Arnim (2019), similar to Taylor and Ömer (2019a) and
1683 Taylor and Ömer (2019b), analyse changes in the functional distribution of income in
1684 the US post-war economy from 1948 to 2017. By breaking down the changes in the
1685 US wage share in 14 sectors into changes in real compensation, labour productivity,
1686 employment shares and relative prices, the authors divide the period covered into a
1687 'golden age' (1948 to 1979) and a 'neo-liberal era' (1979 to 2017). According to the
1688 authors, the manufacturing sector remains the key to understanding the changes in
1689 the wage share in the post-war period. Whereas in the early 1950s wages grew faster
1690 than productivity, allowing the wage share to grow, in recent decades productivity has

1691 grown faster than wages, resulting in a lower wage share. Like Taylor and Ömer (2019a)
1692 and Taylor and Ömer (2019b), Mendieta-Muñoz, Rada, and Arnim (2019) note that
1693 employment seems to have shifted to stagnating sectors. With reference to Baumol's
1694 cost sickness (Baumol and Bowen 1965; Baumol 1967; Baumol, Ferranti, et al. 2013) and
1695 the dual development model of Lewis (1954), the authors argue that while evidence of
1696 cost sickness can be found, there is no upward convergence of real wages. Instead, a
1697 "reverse Lewis shift", the authors argue, may explain the role of stagnating sectors as
1698 places of absorption of excess labour.

1699 Hein and Tarassow (2010) use AMECO data for Austria, France, Germany, the
1700 Netherlands, the UK and the US to test for Verdoorn's law for a period of 1960 to 2007.
1701 Following Naastepad (2006), they include the Marx-Webb effect³ into their estimation
1702 equation. The Marx-Webb effect states a positive relationship between wage growth
1703 and productivity growth, with causality running from the former to the latter. The
1704 general idea is that higher costs of production in form of higher wages incentivise
1705 capitalists to invest more into labour-saving technology, therefore increasing labour
1706 productivity. In the case of Hein and Tarassow (2010), however, the argument is directly
1707 tied to the increase in demand which triggers Verdoorn's law as well. In the case of the
1708 Marx-Webb variable though, it is lower unemployment and the resulting increase in
1709 bargaining power of workers and trade unions that lead to the increase in real wage
1710 growth. Contrary to Naastepad (2006), Hein and Tarassow (2010) suggest to use the
1711 wage share instead of real wage growth as independent variable. The reasoning here
1712 is that capitalists would only be incentivised to innovate if real wages rise faster than
1713 productivity, thus increasing the wage share. The authors use error-correction models
1714 (ECM) to distinguish between a short-run and a long-run effect. While this distinction

³Hein and Tarassow (2010) call this the 'wage-push effect'.

1715 yields lower overall effects than commonly found in the literature on Verdoorn's law,
 1716 it provides another buffer of security against the trap of confusing Verdoorn's law (a
 1717 long-run phenomenon) with Okun's law (a short-run phenomenon). They do however
 1718 not control for the static-dynamic paradox which is well-documented in the literature
 1719 on Verdoorn's law. As the use of logarithmic levels usually leads to lower estimates of
 1720 Verdoorn's law, the passionate reader might be equally interested in the 'upper bound'
 1721 commonly found in estimation specifications using growth rates.

1722 2.4 Methodology

1723 There exist four different ways to measure Verdoorn's law. The simplest way is the one
 1724 shown by Verdoorn (1949) himself. Here, productivity growth in sector j of country i
 1725 (\dot{y}_{ij}) is being regressed on output/demand growth \dot{q}_{ij} . Most of the literature assumes
 1726 Verdoorn's law to be valid only for manufacturing. The meta-regression analysis
 1727 conducted in chapter I most of the time does not find statistically significant differences
 1728 between manufacturing and non-manufacturing. Even if it finds differences, the results
 1729 for non-manufacturing show lower Verdoorn effects than for manufacturing.

$$\dot{y}_{ij} = \alpha + \beta_1 \dot{q}_{ij} + \epsilon_{ij} \quad (2.2)$$

1730 Equation 2.2 suffers from possible simultaneity bias. As output/demand growth
 1731 is influenced by productivity growth, it might be preferable not to use productivity
 1732 growth. Hence Kaldor (1966) proposes a different econometric specification, using
 1733 the fact that by definition productivity growth is defined as the difference between
 1734 output/demand growth and employment growth \dot{e} , or $\dot{y} \stackrel{!}{=} \dot{q} - \dot{e}$.

$$\dot{q}_{ij} = \gamma + \beta_2 \dot{q}_{ij} + \epsilon_i \quad (2.3)$$

1735 which is equal to

$$\dot{e}_{ij} = -\alpha + (1 - \beta_1) \dot{q}_{ij} + \epsilon_{ij}$$

1736 Kaldor (1966) stressed the importance of aggregate demand in determining the
 1737 long-run rate of growth via cumulative causation and increasing returns to scale.
 1738 However, Rowthorn (1975) argued that Kaldor's (1966) specification was flawed, as the
 1739 economy is ultimately supply-constrained, and thus output growth should be regressed
 1740 on employment growth - precisely the inverse of what Kaldor (1966) was arguing.

$$\dot{q}_{ij} = \delta + \beta_3 \dot{q}_{ij} + \epsilon_{ij} \quad (2.4)$$

1741 or

$$\dot{q}_{ij} = \frac{\alpha}{1 - \beta_1} + \frac{1}{1 - \beta_1} \dot{q}_{ij} + \epsilon_{ij}$$

1742 Rowthorn's (1975) contribution also gave way to a second, less often quoted in-
 1743 terpretation, where instead of regressing output growth on employment growth, we
 1744 exchange output growth for productivity growth. Both versions of Rowthorn's specifi-
 1745 cations by definition need to yield the same implied results for Verdoorn's law, hence
 1746 for econometric estimation of Rowthorn's specification we will only use equation 2.4.

$$\dot{y}_{ij} = \delta + \beta_4 \dot{q}_{ij} + \epsilon_{ij} \quad (2.5)$$

1747 or

$$\dot{y}_{ij} = \frac{\alpha}{1 - \beta_1} + \frac{\beta_1}{1 - \beta_1} \dot{e}_{ij} + \epsilon_{ij}$$

1748 As was already argued in chapter I, there is no objective way to determine which of
1749 the four specifications should be used to properly estimate Verdoorn's law. Rather this
1750 decision comes down to the researcher and her views on how the economy operates.
1751 If one believes that the economy ultimately is demand-led, then one of Rowthorn's
1752 two specifications will be seen as the correct one. If however one is convinced that
1753 demand-side variables are the real constraint, then Kaldor's interpretation of Verdoorn's
1754 law makes more sense.

1755 Another important subject of discussion includes the question whether or not to
1756 include growth rate of the stock of capital into the regression specification. Not doing so
1757 might lead to omitted variable bias, as the stock of capital correlates with productivity
1758 growth. One might refrain from including capital stock growth however, as *capital*
1759 *accumulation is a symptom rather than cause of growth'* (Kaldor 1968, p.390). Again this
1760 debate is tightly linked to one's belief whether the economy is ultimately supply- or
1761 demand-led.

1762 Rowthorn (1975) argued that in the case of Japan's growth experience after world
1763 war II, most of the increase in productivity could be explained by its' technological
1764 catching-up to other more advanced countries. In this case, Japan's experience would
1765 not be an occurrence of Verdoorn's law. Hence, one should add as a control variable the
1766 initial level of productivity relative to that of more advanced countries (for example the
1767 US) when estimating Verdoorn's law. As different countries will have different levels of
1768 economies of scale, even with the same starting technologies countries will experience

1769 different levels of productivity.

1770 Finally, there exists a paradox in the literature, where using growth rates or log-
1771 arithmic levels yields different results, something which *a priori* should not happen.
1772 Typically speaking, the use of growth rates yields increasing, statistically significant
1773 returns to scale while using logarithmic levels yield either no statistically significant or
1774 constant to scale.

1775 Basu and Budhiraja (2020) argue that while an empirical estimation of Verdoorn's
1776 law might be relatively straightforward, its interpretation is much harder. The authors
1777 argue that this is because Verdoorn's law is representing deeper mechanisms found in
1778 the sphere of production as well as the labour market. While proponents of demand-side
1779 explanations see Verdoorn's law as a proof for increasing returns to scale and demand-
1780 induced technical progress, supply-side proponents tend to find results in favour of
1781 constant returns to scales instead. Basu and Budhiraja (2020) propose a theoretical
1782 framework for such interpretation, using a formal model via which Verdoorn's law
1783 is derived. The model itself is based on a general constant elasticity of substitution
1784 production (CES) function and can be derived from both a Cobb-Douglas or Leontief
1785 production function as special cases. The resulting model suggests that the coefficient
1786 representing Verdoorn's law is a product of returns to scale, the elasticity of factor
1787 substitution, the profit share and the elasticity of the labour supply. Following this
1788 result, a 'well-behaved' Verdoorn's law-coefficient cannot be directly translated into
1789 proof of increasing returns to scale without knowing the size of the other parameters.

1790 A shortened version of the model proposed is as follows. Using a standard CES
1791 production function and deriving for productivity growth \dot{y} , the resulting relationship
1792 becomes

$$\dot{y} = \dot{b} + \pi(\dot{k} - \dot{e}) \quad (2.6)$$

1793 where \dot{b} stands for technological change, π for the profit share, \dot{k} for the growth
 1794 in the stock of capital and \dot{e} or employment growth. Depending on how one believes
 1795 technological change to happen (via economies of scale external to the firm or dynamic
 1796 economies of scale), the assumption of labour market equilibrium and either external or
 1797 dynamic economies of scale, Basu and Budhiraja (2020) find a relationship between the
 1798 growth rates of the capital stock and employment that is consistent with labour market
 1799 equilibrium. Combining this market equilibrium condition, one finds two different
 1800 Verdoorn coefficients, namely

$$\beta = \frac{\mu\pi(1 - \sigma) + \frac{\sigma}{\eta}\pi + \mu}{\pi + \mu\sigma + \mu\pi(1 - \sigma) + \frac{\sigma}{\eta}(\pi + \mu)} \quad (2.7)$$

1801 in the case of economies of scale external to the firm, often assumed in the economic
 1802 mainstream, and

$$\beta = \frac{\sigma + \xi\eta(1 - \sigma)}{\eta + \sigma} \quad (2.8)$$

1803 in the case of dynamic economies of scale, as commonly used in heterodox eco-
 1804 nomics. β represents the Verdoorn coefficient, μ the returns to scale, profit share the
 1805 profit share, elasticity of labour supply with respect to the real wage the elasticity of
 1806 labour supply with respect to the real wage, elasticity of substitution between labour
 1807 and capital the elasticity of substitution and effect of demand-induced technical change
 1808 the effect of demand-induced technical change.

1809 If, for example, one can estimate β, σ, π and η , then one could directly calculate the

1810 returns to scale μ .

1811 Basu and Budhiraja (2020) provide value added in that they emphasise the limits of
1812 directly inferring increasing returns to scale from Verdoorn effects between 0 and 1,
1813 something proposed very often in the literature on Verdoorn's law. They also show that
1814 'on pure theoretical grounds, a Cobb-Douglas production function seems to be ruled
1815 out as a good characterisation of technology in a labour surplus economy undergoing
1816 structural change' (Basu and Budhiraja 2020, pp.14).

1817 While Basu and Budhiraja (2020) make for an interesting thought experiment, the use
1818 of a Cobb-Douglas production function as a base for a formal model of Verdoorn's law is
1819 highly questionable. Time and again it has been argued that estimations of production
1820 functions merely capture an underlying accounting identity, and thus statistically
1821 significant results cannot be used to verify certain production functions (Shaikh 1974;
1822 Felipe and McCombie 2003; Felipe and McCombie 2011). Felipe and McCombie (2013)
1823 summarise the pre-existing critique of attempts at empirical verification of neoclassical
1824 production functions, namely the Cambridge Capital Controversies and the aggregation
1825 literature. The authors provide ample evidence that the apparently good fit of theory
1826 and economic data lies in the fact that relates value added with wages and profits. The
1827 perfect fit is therefore not the result of high theory but simply the result of regressing
1828 an accounting identity. This becomes even more important in the case of Basu and
1829 Budhiraja (2020). In chapter 11, Felipe and McCombie (2013) discuss empirical studies
1830 concerned with neoclassical labour market theory and show that due to accounting
1831 identity issues, labour demand curve estimations will always yield downward-sloping
1832 labour demand curves. In their own words, 'no reliance can be placed on estimates of
1833 the wage elasticities in formulating economic policy' (Felipe and McCombie 2013, p.
1834 307).

1835 Taking the issues raised in the previous paragraph serious, the only option left is to
 1836 assume the underlying production function in Basu and Budhiraja's (2020) model of
 1837 Verdoorn's law to be of the Leontief type. In the case of equations 2.7 and 2.8, this is
 1838 equal to assuming that $\sigma = 0$ (in the case of a Cobb-Douglas production function, σ
 1839 would be equal to 1). Doing so yields Verdoorn coefficients of

$$\beta = \frac{1 + \frac{1}{\pi}}{1 + \frac{1}{\mu}} \quad (2.7')$$

1840 in the case of economies of scale external to the firm. Here, for the economies of
 1841 scale μ to be positive, the Verdoorn effect β needs to fulfil the two conditions $\beta > 0$
 1842 and $\beta < 1 + \frac{1}{\pi}$. Drawing from the results found in numerous literature surveys on
 1843 Verdoorn's law as well as the results of our own meta-regression conducted in chapter
 1844 I, we can safely assume these two conditions to hold. The heterodox representation of
 1845 Verdoorn's law, assuming $\sigma = 0$, yields

$$\beta = \xi \quad (2.8')$$

1846 in the case of dynamic economies of scale. As we can see, in the case of dynamic
 1847 economies of scale under a Leontief production function economy, the Verdoorn coeffi-
 1848 cient β equals the effect of demand-induced technical change ξ . Using these assump-
 1849 tions based on the critique of production functions presented above thus lets Basu and
 1850 Budhiraja's (2020) argument vanish.

1851 2.5 The Data

1852 For our analysis, we use the EU-KLEMS data set provided by the Vienna Institute for
1853 International Economic Studies (WIIW). It contains the latest update of the EU KLEMS
1854 database, which is funded by the 'DG Economic and Financial Affairs' of the European
1855 Commission. To our knowledge, this is the first time the EU-KLEMS data set is used in
1856 order to estimate Verdoorn's law.

1857 With the release of the 2019 version of EU-KLEMS, the database provides mea-
1858 surements of economic growth, productivity, employment, capital formation and tech-
1859 nological change at sector level for all Member States of the European Union, Japan
1860 and the United States. The productivity measurements have been developed using
1861 growth accounting techniques. Furthermore, the EU KLEMS Release 2019 includes
1862 additional indicators on intangible assets. An overview and summary of design issues
1863 and methodology can be found in Stehrer et al. (2019). In total, the database covers
1864 53 sectors and sub-sectors from 1998 to 2017 for Austria, Belgium, Bulgaria, Croatia,
1865 Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary,
1866 Ireland, Italy, Japan, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland,
1867 Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom, the United
1868 States and Cyprus. In addition, several groupings have been created for European
1869 countries (EU15, EU27, EU28 and EA19 for the euro area).

1870 First, we derive two different measures of productivity from the known ratio:

$$productivity = real\ output/employment$$

1871 We start with productivity, since productivity is the link between production, em-

ployment and distribution (Taylor and Ömer 2019a). In theory, both productivity measures should produce similar results, so that one can be used as a control for the other.

We used the data provided by EU-KLEMS to calculate by country and year the manufacturing sector's share of total value added and the difference between productivity levels relatively to the US. We further create logarithms of all variables needed for the regressions. We also create growth rates for the same variables. This enables us to check whether the static-dynamic paradox holds for the area and periods covered in this study.

The KLEMS data set suffers from several omitted entries which are neither entirely random nor structured in nature. Some countries are not reporting any variable for one or multiple entire years, usually at the beginning of the time period covered by EU-KLEMS. For example, data for Germany are missing for 1995. France, Italy and the UK do not report data for sector U in EU-KLEMS (defined as '*Activities of extraterritorial Organisations and bodies*'). Sometimes the problem lies in different reporting standards, where different countries reported at different sectoral levels. These problems render panel analysis difficult, as the negligence of missing entries could lead to emergent bias. In order to combat these limitations, several steps were undertaken. First, only sectors which were equally reported across all member countries were used for our analysis. Second, the existing data set observations were used to interpolate and extrapolate values for the missing values which were used for the regressions. This procedure led to a more balanced panel. Finally, we use the *xtbalance* command in STATA in order to create entirely consistent panel data without any missing entries at all. This gives us much better data quality at the cost of overall observations.

As a result of balancing our data, we unfortunately lose a few countries. After the

1897 necessary data processing, we are left with a data set of 17 aggregated industries for 23
1898 countries for the period 1995 to 2017. The resulting strongly balanced data set leaves us
1899 with Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland,
1900 France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Livonia, Luxembourg, the
1901 Netherlands, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden. We do believe
1902 that the information lost by not including the rest of the EU28 members is compensated
1903 by the consistency of the data from the remaining members.

1904 For our first set of regressions we try to estimate an ECM model. Here, the first
1905 step is to rule out potential unit roots in our series, i.e. make sure that our series are
1906 stationary. The (non-)stationary of a series strongly influences its behaviour. If a series
1907 is non-stationary, then a shock to the system will persist forever in its effect. Equally,
1908 if two variables are co-integrated⁴, the regression of one variable on the other would
1909 yield a higher R^2 , even if there is no underlying relation between both variables. Most
1910 importantly, if any variables in our regression model are non-stationary, then standard
1911 assumptions for asymptotic analysis will not be valid. The usual t-ratios will not follow
1912 a t-distribution, so our hypothesis tests about the regression parameters would not be
1913 valid.

1914 There exist a variety of tests for unit roots (or stationarity) in panel data sets.
1915 The tests by Levin, Lin, and James Chu (2002), Harris and Tzavalis (1999), Breitung
1916 and Das (2005), Im, Pesaran, and Shin (2003), and Choi (2001) tests all have as the
1917 null hypothesis that all the panels contain a unit root. Since our data set has a large
1918 number of observations but a fixed amount of time periods, we identify possible unit
1919 roots with unit root tests following Harris and Tzavalis (1999). The Harris–Tzavalis test

⁴if (X,Y,Z) are each integrated of order d , and there exist coefficients a,b,c such that $aX + bY + cZ$ is integrated of order less than d , then $X, Y,$ and Z are co-integrated

1920 assumes that all panels have the same auto-regressive parameter ρ under the alternative
1921 hypothesis of stationarity. In the case of non-stationarity, we take the first difference
1922 and test again. If one differentiation is required to obtain a co-variance-stationary
1923 series, then the variable is known to be integrated of the first order (also known as
1924 'I(1)'). None of our variables is integrated of a higher order than one, i.e. our variables
1925 are I(1) at most.

1926 Next we test the I(1) variables for co-integration. In other words, we test whether
1927 our I(1) variables share a long-run equilibrium relation. We do so using the '*xtcointtest*'
1928 command in STATA. The *xtcointest* command uses five different versions of the
1929 Dickey-Fuller test (normal, augmented, modified, unadjusted augmented and unad-
1930 justed modified) to test for co-integration. In all cases, our I(1) variables are found to be
1931 co-integrated.

1932 We are interested in estimating Verdoorn's law, which is supposed to be more of a
1933 long-run relation. Most studies in the available literature do not differentiate between
1934 the long run and the short run. Estimating short-run relations between productivity
1935 and output could be an issue in that we might not estimate Verdoorn's law but rather
1936 Okun's law⁵. Okun's law is supposed to be a short-run phenomenon. Not differentiating
1937 between short run and long run might lead to inflated estimates of Verdoorn's law
1938 (Hein and Tarassow 2010). The immediate idea of estimating Verdoorn's law via the use
1939 of an error-correction model (ECM) cannot be realised. Error-correction models need
1940 all estimates to be integrated of the same order, and not more than (1). In none of our
1941 cases this is the case. We therefore would like to apply an auto-regressive distributed
1942 lag (ARDL) approach. ARDL models allow us to use I(0) and I(1) variables together
1943 in the same regressions while differentiating between long-run and short-run effects.

⁵see chapter I

1944 With respect to the findings in our MRA, one needs to remind oneself that the use of
1945 ECM and ARDL models does not seem to be needed, as we found no difference between
1946 long-run and short-run regression specifications⁶.

1947 However, given our data set, there are issues of possible cross-sectional dependency
1948 and multicollinearity that need to be addressed. These issues are not taken into account
1949 in normal ARDL models. Also, we argue that while the countries in our data set all
1950 harbour manufacturing sectors, there is substantial heterogeneity among them. Some
1951 countries run current account surpluses while others run current account deficits; some
1952 countries might have a high share of manufacturing in value added while others have
1953 experienced prolonged periods of de-industrialisation. In order to take into account the
1954 possibility of these unobserved common factors between units, our first specification
1955 consists in a 'dynamic common correlated effects' (DCCE) model. To do so, cross
1956 sectional averages are added in the fashion of Pesaran (2006). Normal pooled CCE
1957 models keep the parameters constrained in such a way that they are the same across
1958 units. In case of a pooled estimation, the standard errors are obtained from a mean
1959 group regression run in the background (Pesaran 2006). The pooled CCE model however
1960 differentiates only between homogeneous long-run and heterogeneous short-run effects.
1961 DCCE models are able to work with heterogeneity in both the short run and the long
1962 run.

1963 For our model we are using the *xtdcce2* STATA package (Ditzen 2021). The docu-
1964 mentation can be found in STATA as well as in the package's [GitHub-page](#). Following
1965 Levin, Lin, and James Chu (2002), for each time period we first compute the mean of
1966 the series across panels and then subtract the cross-sectional averages from the series.
1967 Levin, Lin, and James Chu (2002) suggest this procedure to mitigate the impact of

⁶again, see chapter I

cross-sectional dependence.

The results of our DCCE model need to be interpreted as short-run phenomenon. We are however interested in long-run relations in order to properly differentiate between Okun's law and Verdoorn's law. As was explained before, traditional ARDL models are not able to take into account possible cross-sectional dependence. Fortunately, the *xtdcce2* STATA package provides the possibility of an augmented ARDL model which takes into account cross-sectional dependence. This 'cross-section augmented ARDL' (CS-ARDL) model is our ideal candidate to estimate Verdoorn's law in our panel model and thus represents our second specification. The CS-ARDL model estimates both short-run and long-run coefficients, taking into account cross-sectional dependence. For these reasons, we will recommend the reader to use the second specification as baseline scenario. The 'Cross-Section Augmented ARDL' (CS-ARDL) model developed by Chudik and Pesaran (2016) works with heterogeneous effects both in the short as well as in the long run, controlling for cross-sectional dependence and multicollinearity. All variables are treated as long run coefficients. *xtdcce2* first estimates the short run coefficients and then calculates the long run coefficients. Furthermore, *xtdcce2* checks for collinearity in three different ways (Ditzen 2021).

We are regrettably rather limited in our possibilities to properly use CS-ARDL to its fullest. The short time span of 20 years provides a natural limit of degrees of freedom. The combination of four long-run independent variables eight cross-sectional means (including the one-period lags) already uses twelve of our degrees of freedom. Including the same four variables as short-run variables would double the amount of degrees of freedom needed for the estimation of cross-sectional means. The four short-run variables then increase the absolute number of degrees of freedom needed by four more. In total the amount of degrees of freedom needed would be more than is available in

1993 our case. Our analysis is thus constrained by the consistent time periods available in
1994 our data set. It would make sense to repeat it once the EU-KLEMS data are updated, so
1995 that hopefully more time periods become available. This would also allow us to include
1996 more lags for the computation of cross-sectional means.

1997 For our regressions we will use equation 2.2. The results for the other specifications
1998 are available in the appendix. Our baseline scenario is using the dynamic version
1999 of Verdoorn's law in growth rates, rather than the logarithmic levels of output and
2000 productivity. We choose this approach because first it is the original approach used by
2001 Verdoorn (1949), Kaldor (1966) and Rowthorn (1975) and secondly because the use of
2002 logarithmic levels is tied to the idea of a Cobb-Douglas production function, which we
2003 avoid to use for the weak theoretical grounds on which it stands (Shaikh 1974; Felipe
2004 and McCombie 2003; Carter 2011; Felipe and McCombie 2013). We do not include the
2005 growth in the stock of capital in our reference specification as '*capital accumulation is*
2006 *a symptom rather than cause of growth*' (Kaldor 1968, p.390). Additionally, we follow
2007 Hein and Tarassow (2010) in that we control for the change in the wage share as an
2008 alternative to the change in real wages. Further control variables include a) the value
2009 added share of the respective country's manufacturing sector in order to control for
2010 structural change and b) the difference in the productivity level with regards to the US
2011 to control for a potential technological catching-up process. All regressions were made
2012 using STATA 16.

2013 **2.6 Results**

2014 Verdoorn's law is supposed to be valid for manufacturing only, which is why we start
2015 with our analysis with manufacturing sectors from our 23 countries. Following Stehrer

et al. (2019), we use the 'NACE Rev. 2 one-digit industry classification' for our sector classification. Table 2.1 reports the results for Verdoorn's specification of Verdoorn's law (equation 2.2) for total manufacturing, once with real wages and once with the wage share instead. Both variants are being estimated first using a dynamic CCE model, with the CS-ARDL model second. Sadly, STATA only reports the normal R2 and not the R2 of the mean groups, which is much higher (in the case of the Verdoorn specification, the mean group R2 lies between 0.78 and 0.98). All significance stars start at the 10% level.

Let us start by looking at the results using real wages in column 1. First, we used the DCCE model which takes into account cross-sectional dependence but only represents a short-run relationship. Hence, we are unable to distinguish between Okun's law and Verdoorn's law. We find a statistically significant effect of output growth of 0.631, represented by 'value added growth'. This result is close to the average value found in the Verdoorn literature (McCombie, Pugno, and Soro 2002). All our other control variables however are not to be found statistically significant. This includes real wage growth, which is supposed to embody Marx-Webb effects associated with capitalists incentives to use labour-saving machinery to increase labour productivity, higher motivation of workers from higher salaries and political bargaining which includes a power struggle argument.

As we argued, the results obtained from the DCCE estimation can only be interpreted as a short-run perspective. The CS-ARDL estimation method manages to differentiate between short-run and long-run effects just like normal ARDL models, while also taking into account cross-sectional dependence. Its results can be seen in column 2. The short-run Verdoorn effect is 0.863 now, higher than in the DCCE estimate. This time, real wage growth are statistically significant as well, with a coefficient of 0.198.

2041 ARDL models also include long-run versions of the independent variables. Here, three
2042 variables are found to be statistically significant. First, $l_g_VA_Q$, the long-run version
2043 of value added is very close to one, at a level of 0.966. This is an interesting find, as
2044 while it still implies increasing returns to scale, the resulting returns to scale are very
2045 close to constant returns to scale, which is at odds with the usual assumptions made
2046 in the literature on Verdoorn's law. Second, real wage growth does seem to have a
2047 positive long-run effect here, with a value of 0.235. Hence, our CS-ARDL model using
2048 real wages suggests that real wage growth is productivity-enhancing in both the short
2049 as well as the long run.

2050 Let us now look at the same estimation specification, this time using the wage share
2051 instead of real wage growth. Hein and Tarassow (2010) argued that productivity growth
2052 should be regressed on the wage share instead of real wage growth, as capitalists will
2053 only be incentivised to invest in labour-saving technology if real wages grow faster than
2054 productivity, thereby increasing the wage share. In the DCCE estimation in column
2055 3, both output growth and the wage share do have statistically significant coefficients
2056 (0.839 and 0.310), suggesting that both the combination of Okun's and Verdoorn's law
2057 and the Marx-Webb effect play a role, at least in the short run. Notably, the combined
2058 Okun/Verdoorn effect is higher than using real wages. Using the CS-ARDL approach in
2059 column 4 instead, the short-run Verdoorn effect stays approximately the same (0.859).
2060 There are however no long-run effects to be found. In short, using the wage share in this
2061 specification, we cannot find any sign for neither Verdoorn's law nor the Marx-Webb
2062 effect to be at work.

2063 Table 2.2 shows us the results for total manufacturing, this time using levels in
2064 logarithms instead of growth rates. We do use both measures because of the 'static-
2065 dynamic paradox' frequently found in the literature (McCombie, Pugno, and Soro 2002).

Table 2.1 – Verdoorn’s Law in Total Manufacturing (Verdoorn specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
value added growth	0.631+ (0.124)	0.863+ (0.088)	0.839+ (0.147)	0.859+ (0.092)
real wage growth	0.048 (0.068)	0.198+ (0.048)		
productivity difference growth	-0.112 (0.112)	-0.115 (0.129)	-0.185** (0.092)	-0.177 (0.108)
L.g_gdpperworker	-0.013 (0.045)	0.027 (0.052)	-0.030 (0.065)	-0.043 (0.082)
D.Manufacturing share of value added	0.017 (0.011)		0.005 (0.011)	
Manufacturing share of value added		-0.013* (0.007)		0.003 (0.006)
lr_VA_share_manuf		-0.015* (0.009)		0.002 (0.006)
lr_cons		-0.041 (0.160)		1.473 (1.877)
lr_g_GAP		-0.093 (0.137)		0.038 (0.182)
lr_g_VA_Q		0.966+ (0.123)		0.456 (0.391)
lr_g_gdpperworker		-0.973+ (0.052)		-1.043+ (0.082)
lr_g_real_wages		0.235+ (0.062)		
wage share by industry			0.310** (0.125)	0.178 (0.130)
lr_wshare_by_industry				-0.230 (0.359)
Constant	-0.032 (0.115)	-0.052 (0.143)	-0.955 (0.783)	-0.974 (0.776)
Observations	437	437	437	437
R2	0.04	0.05	0.02	0.03

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

2066 The paradox consists in that Verdoorn effects are often found using growth rates, but
2067 much less often when using logarithms. Verdoorn effects found using logarithms are
2068 usually finding results implying constant returns to scale, while estimations using
2069 growth rates typically find results consistent with increasing returns to scale.

2070 As both value added and real wages were found to be non-stationary, we had
2071 to estimate this DCCE specification using first differences. Here, we find a combined
2072 Okun/Verdoorn effect of 0.560, close to the result obtained using growth rates. Hence,
2073 a one percentage-increase in value added implies a 0.560%-increase in productivity
2074 growth. This time, real wage growth is found to be statistically significant as well, with
2075 a coefficient of 0.181. Again, these results are only representing the short run. Taking
2076 into account the long-run effects with our CS-ARDL estimate, we find a (long-run)
2077 Verdoorn effect of 0.359. The short-run effect of value added on productivity - possibly
2078 representing Okun's law - yields a value of 0.325. Real wages do not have any impact,
2079 neither in the short run nor in the long run when using logarithmic real wages. In the
2080 case of the wage share as measurement for Marx-Webb effects, no Okun/Verdoorn effect
2081 combination nor wage push effect can be found. Using the CS-ARDL approach, we
2082 find a short-run effect of 0.378, consistent with Okun's law, and a long-run Verdoorn
2083 effect of 0.392. We also find statistically significant wage share coefficients which are
2084 negative and very close in size in both the short and the long run (-0.533 and -0.504).
2085 This result seems to be hard to explain with theory and is similar to some of the results
2086 found in Hein and Tarassow (2010). Also, in all results for total manufacturing, the
2087 constant representing the autonomous growth in productivity is negative. This means
2088 that absent any demand- or wage-induced technical change, there would be an actual
2089 decrease in productivity happening.

2090 The results for total manufacturing can be limiting regarding observations, as we

Table 2.2 – Verdoorn’s Law in Total Manufacturing (Verdoorn specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
productivity difference (log)	-0.114 (0.086)	-0.262 (0.258)	-0.313* (0.179)	-0.373 (0.296)
LD.productivity (log)	-0.135+ (0.038)		-0.103 (0.078)	
L.productivity (log)		-0.018 (0.058)		-0.101* (0.060)
D.value added (log)	0.560+ (0.134)		0.510*** (0.153)	
value added (log)		0.325*** (0.113)		0.378*** (0.112)
D.real wages (log)	0.181*** (0.065)			
real wages (log)		-0.017 (0.083)		
D.Manufacturing share of value added	0.019* (0.010)		0.019 (0.012)	
Manufacturing share of value added		0.019** (0.009)		0.009 (0.009)
lr_VA_share_manuf		0.018** (0.008)		0.010 (0.008)
lr_cons		-1.168 (1.078)		-1.491 (1.331)
lr_ln_GAP		-0.234 (0.253)		-0.285 (0.241)
lr_ln_VA_Q		0.359*** (0.129)		0.392+ (0.094)
lr_ln_gdpperworker		-1.018+ (0.058)		-1.101+ (0.060)
lr_ln_real_wages		-0.003 (0.085)		
D.wage share by industry			-0.149 (0.137)	
wage share by industry				-0.533+ (0.076)
lr_wshare_by_industry				-0.504+ (0.079)
Constant	-1.268 (1.250)	-1.086 (1.171)	-1.377 (1.099)	-1.214 (1.465)
Observations	342	360	342	360
R2	0.07	0.07	0.06	0.05

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

2091 have only 20 years per country and our panel consists in 23 countries. Aside from
2092 total manufacturing, the EU-KLEMS data set does report values for manufacturing
2093 sub-sectors as well. This allows us to run the regression models on a bigger panel with
2094 14 sub-sectors per country, representing 21 sub-sectors in total. This increases the
2095 number of observations from 342/360 to 5757. We hope to increase the statistical power
2096 of our findings this way.

2097 The results for the manufacturing sub-sectors can be found in table 2.3. Our DCCE
2098 specification yields statistically significant and positive results for both output growth
2099 and real wage growth. Compared to the results in table 2.1, the results for output
2100 growth are higher (0.751 vs. 0.631). Our CS-ARDL model finds short-term effects for
2101 both output growth and real wage growth of the same magnitude. Additionally, we find
2102 a very high value for Verdoorn's law (0.755) and a slightly higher value for long-run
2103 real wage growth than in table 2.1 (0.259 vs. 0.235). Using wage shares instead of
2104 real wages, the short-run Marx-Webb effect ceases to exist while the high coefficient of
2105 output growth increases (0.808). Contrary to table 2.1, this time we do find a (long-run)
2106 Verdoorn effect of 0.782, but no Marx-Webb effect. The short-run effect of value added
2107 stays in line with the other specifications in table 2.3.

2108 Table 2.4 shows the estimations for manufacturing sub-sectors using logarithms.
2109 Our DCCE specification finds statistically significant coefficients for value added (0.576)
2110 and real wages (0.249). The CS-ARDL specification yields short-run coefficients which
2111 are very close to the ones in the DCCE specification (0.600 and 0.261). Furthermore,
2112 we find long-run coefficients for value added (0.694) and real wages (0.315). Using the
2113 wage share instead of real wages, in the DCCE specification the value added coefficient
2114 stays roughly equal while the wage share coefficient is negative again. The CS-ARDL
2115 estimation presents short-run coefficients of 0.616 and -0.455 for value added and the

Table 2.3 – Verdoorn’s Law in Manufacturing Sub-sectors (Verdoorn specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
value added growth	0.751+ (0.028)	0.725+ (0.027)	0.808+ (0.036)	0.777+ (0.040)
real wage growth	0.215+ (0.026)	0.247+ (0.025)		
productivity difference growth	-0.101+ (0.024)	-0.110+ (0.024)	-0.146+ (0.027)	-0.155+ (0.034)
L.g_gdpperworker	-0.025 (0.015)	-0.048*** (0.015)	-0.055*** (0.019)	-0.082+ (0.020)
D.Manufacturing share of value added	-0.004 (0.007)		0.004 (0.013)	
Manufacturing share of value added		-0.003 (0.003)		-0.010*** (0.004)
lr_VA_share_manuf		-0.004 (0.003)		-0.018*** (0.006)
lr_cons		-0.175 (0.359)		-2.816* (1.700)
lr_g_GAP		-0.113+ (0.027)		-0.082* (0.048)
lr_g_VA_Q		0.755+ (0.030)		0.782+ (0.129)
lr_g_gdpperworker		-1.048+ (0.015)		-1.082+ (0.020)
lr_g_real_wages		0.259+ (0.028)		
wage share by industry			-0.032 (0.059)	-0.082 (0.058)
lr_wshare_by_industry				-0.079 (0.115)
Constant	-0.407 (0.282)	-0.337 (0.360)	0.238 (0.788)	-0.426 (0.841)
Observations	5757	5757	5757	5757
R2	0.01	0.01	0.01	0.01

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

2116 wage share. In the long run, we find a statistically significant Verdoorn effect of 0.644
 2117 and a Marx-Webb effect of -0.630 .

Table 2.4 – Verdoorn's Law in Manufacturing Sub-sectors (Verdoorn specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
value added (log)	0.576+ (0.032)	0.600+ (0.034)	0.611+ (0.036)	0.616+ (0.041)
real wages (log)	0.249+ (0.032)	0.261+ (0.030)		
productivity difference (log)	-0.192+ (0.037)	-0.181+ (0.037)	-0.204+ (0.038)	-0.182+ (0.032)
L.productivity (log)	0.057*** (0.021)	0.029 (0.022)	0.066*** (0.021)	0.053** (0.023)
D.Manufacturing share of value added	0.009* (0.005)		0.006 (0.005)	
Manufacturing share of value added		-0.001 (0.005)		-0.007 (0.005)
lr_VA_share_manuf		-0.002 (0.016)		0.021 (0.039)
lr_cons		2.722 (2.865)		0.769 (3.277)
lr_ln_GAP		0.045 (0.264)		-0.115 (0.154)
lr_ln_VA_Q		0.694+ (0.067)		0.644** (0.265)
lr_ln_gdpperworker		-0.971+ (0.022)		-0.947+ (0.023)
lr_ln_real_wages		0.315+ (0.053)		
wage share by industry			-0.443+ (0.066)	-0.455+ (0.069)
lr_wshare_by_industry				-0.630*** (0.199)
Constant	0.296 (0.571)	0.148 (0.566)	0.258 (0.630)	-0.011 (0.620)
Observations	4040	4040	4040	4040
R2	0.02	0.02	0.04	0.04

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

2118 As was already mentioned before, Verdoorn's law is assumed to be existent in

2119 manufacturing only. The reasoning usually put forward lies in the increasing returns to
2120 scale which are assumed to be especially prevalent in manufacturing. Furthermore, our
2121 meta-regression analysis in chapter I finds no significant effect of estimating Verdoorn's
2122 law using non-manufacturing data or data of all sectors at once. We therefore run
2123 another set of estimations, this time including all economic sectors according to the
2124 NACE Rev. 2 one-digit industry classification.

2125 Our DCCE estimation in table 2.5 finds value added growth and real wage growth
2126 coefficients consistent with our previous results (0.602 and 0.238). The CS-ARDL finds
2127 short-run coefficients close to our DCCE-specification and a long-run coefficient of value
2128 added growth of 0.781. Real wage growth, in this case, is not statistically significant in
2129 the long run. In the case of using the wage share, the results are similar. The DCCE
2130 specification finds a short-run coefficient of 0.649, without any statistically significant
2131 Marx-Webb coefficient. The CS-ARDL specification yields short run coefficients of
2132 0.673 for value added growth and -0.302 for the wage share. The long-run coefficients,
2133 however, yield a Verdoorn effect of 0.753 and a Marx-Webb effect of -0.357 .

2134 Table 2.6 presents the results for all economic sectors, using logarithms instead of
2135 growth rates. The DCCE model finds statistically short-run coefficients for value added
2136 (0.504) and real wages (0.250). In the CS-ARDL specification, these stay nearly the
2137 same, while the Verdoorn effect is again close to one (0.923). While the first time this
2138 happened using growth rates, this time the result (and the implications of constant
2139 returns to scale) when using logarithms is in line with the so-called 'static-dynamic
2140 paradox'(McCombie, Pugno, and Soro 2002). The Marx-Webb coefficient in the long-run
2141 is 0.193. Using the wage share instead of real wages, we get different results. The DCCE
2142 results are smaller than in other specifications for both the value added as well as the
2143 wage share coefficients. In the CS-ARDL specification, we find a short-run coefficient

Table 2.5 – Verdoorn's Law in All Main Sectors (Verdoorn specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
value added growth	0.602+ (0.032)	0.583+ (0.029)	0.649+ (0.033)	0.673+ (0.033)
real wage growth	0.238+ (0.026)	0.258+ (0.025)		
productivity difference growth	-0.148+ (0.039)	-0.146+ (0.026)	-0.182+ (0.028)	-0.179+ (0.028)
L.g_gdpperworker	-0.041** (0.016)	-0.050*** (0.017)	-0.056*** (0.021)	-0.071+ (0.019)
D.Manufacturing share of value added	0.002 (0.003)		0.000 (0.005)	
Manufacturing share of value added		-0.007** (0.003)		-0.002 (0.003)
lr_VA_share_manuf		-0.001 (0.007)		-0.001 (0.005)
lr_cons		0.573** (0.259)		0.431 (0.292)
lr_g_GAP		-0.293*** (0.109)		-0.110** (0.056)
lr_g_VA_Q		0.781+ (0.163)		0.753+ (0.170)
lr_g_gdpperworker		-1.050+ (0.017)		-1.071+ (0.019)
lr_g_real_wages		0.128 (0.179)		
wage share by industry			-0.193 (0.130)	-0.302** (0.128)
lr_wshare_by_industry				-0.357** (0.140)
Constant	0.106** (0.042)	0.183*** (0.056)	0.031 (0.173)	0.224 (0.176)
Observations	7106	7106	7106	7106
R2	0.05	0.05	0.08	0.09

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

2144 of 0.533, roughly equally to the rest of the results in table 2.4. Contrary to previous
2145 results, we find no Verdoorn effect in this case.

2146 **2.7 Conclusion**

2147 In this study, we used yearly data from 23 EU countries to study the validity of Verdoorn's
2148 law and the Marx-Webb effect for the period of 1996-2017. We did so via using the EU-
2149 KLEMS data set, which allows us to distinguish at both a sectoral and sub-sectoral level.
2150 Our methodology is relatively novel in that 1) we use an ARDL methodology in order
2151 to distinguish between short-run Okun effects and long-run Verdoorn effects and 2) we
2152 use cross-sectional dependence-robust estimators. Especially the latter methodological
2153 change makes our results less prone to bias than the existing literature.

2154 Comparing our results across different methods, sectors and specifications used, we
2155 can state the following.

2156 First, apart from the estimations in the manufacturing sector using logarithms, all
2157 estimates yield statistically significant values for the the short run effects of output
2158 growth. These values are changing depending on the method used, the sector in
2159 question and the use of real wages or the wage share in the regression function. These
2160 short-run values range from 0.504 to 0.863. We do reckon however that we are not
2161 able to distinguish the short-run effects (which might represent Okun's law) from the
2162 long-run effects (which represent Verdoorn's law) in the case of the dynamic common
2163 correlated effects (DCCE) model. We therefore estimated a second model in an auto-
2164 regressive distributed lag (ARDL) model specification, taking into account potential
2165 cross-sectional dependence (hence CS-ARDL). This model specification enables us to
2166 differentiate between the short run and the long run. Here, the long-run effects of

Table 2.6 – Verdoorn's Law in All Main Sectors (Verdoorn specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wages (log)	0.254+ (0.025)	0.237+ (0.035)		
productivity difference (log)	-0.252+ (0.040)	-0.159*** (0.054)	-0.321+ (0.044)	-0.274+ (0.039)
L.productivity (log)	0.407+ (0.032)		0.393+ (0.035)	0.031 (0.022)
D.value added (log)	0.540+ (0.040)		0.469+ (0.040)	
value added (log)		0.561+ (0.044)		0.533+ (0.041)
D.Manufacturing share of value added	0.002 (0.003)		-0.004 (0.004)	
Manufacturing share of value added		0.005 (0.006)		0.008* (0.004)
L.g_gdpperworker		0.012 (0.018)		
lr_VA_share_manuf		-0.083 (0.091)		0.004 (0.009)
lr__cons		3.792 (3.787)		4.387 (3.517)
lr_g_gdpperworker		-0.988+ (0.018)		
lr_ln_GAP		-0.288** (0.122)		-0.330+ (0.045)
lr_ln_VA_Q		0.923*** (0.320)		-0.097 (0.743)
lr_ln_real_wages		0.193** (0.080)		
wage share by industry			-0.297*** (0.115)	-0.329*** (0.121)
lr_ln_gdpperworker				-0.969+ (0.022)
lr_wshare_by_industry				0.398 (1.114)
Constant	1.464** (0.650)	0.305 (0.923)	2.373+ (0.554)	0.925 (0.683)
Observations	4580	4580	4580	4580
R2	0.03	0.02	0.06	0.05

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

2167 output growth (the Verdoorn effect) ranges are significant in all but three cases: once
2168 using real wages in the static manufacturing specification; once using the wage share in
2169 the dynamic manufacturing specification; and once using the wage share in the static
2170 specification of all main sectors. Nevertheless, overall we find statistically significant
2171 effects of output growth in the long run. Here, the values range from 0.378 to 0.966.
2172 Our findings do therefore provide strong indication that Verdoorn's law is real.

2173 The existence of Verdoorn's law is vital for demand-side economists across all
2174 schools of thought. Post-Keynesians use Verdoorn's law to emphasise the role of
2175 demand, which is affecting growth not only in the short run, but in the long run as well.
2176 Amongst post-Keynesians, Verdoorn's law is especially important for followers the
2177 Kaldorian school of thought, who use it to model structural change. In this way, they
2178 resemble the 'systems of innovations' approach (Mazzucato 2013; Lazonick 2016) and
2179 the (neo-)Schumpeterians (Reinert and Daastøl 2011). Indeed, prototypes of Verdoorn's
2180 law can already be found in the works of Giovanni Botero and Antonio Serra, centuries
2181 before the publication of Verdoorn (1949). Botero and Serra are not without good
2182 company. Adam Smith's argument 'that the division of labour increases with the size of
2183 the market' (Smith 1776), and the analyses into US manufacturing at the beginning of
2184 the 20th century by Solomon Fabricant represent additional attempts at explaining the
2185 importance of manufacturing due to economies of scale. The analysis of demand-side
2186 effects on long-term growth from a macroeconomic perspective is therefore much older
2187 than most demand-led economists might believe.

2188 Verdoorn's law, however, was originally supposed to be valid for manufacturing
2189 only. It was precisely the existence of Verdoorn's law, already present prior in the
2190 works of Alexander Hamilton (1791) and Friedrich List (1838) that led to the emphasis
2191 of development economists and political leadership in countries all over the world to

2192 focus on the development of a strong and independent manufacturing sector. Yet, in
2193 our analysis we find that Verdoorn's law applies to all economic sectors. The immediate
2194 question arises whether this represents a statistical artefact generated by our peculiar
2195 data set, whether the macroeconomic dynamics underlying Verdoorn's law changed or
2196 whether the available literature (especially the older one) failed to take into account
2197 issues like cross-sectional dependence and use strong enough measures to distinguish
2198 between Okun's law and Verdoorn's law. While output growth and productivity growth
2199 are stronger correlated in manufacturing or its sub-sectors in the case of our (short-run)
2200 DCCE models, this relation seems to switch once we look at the long run. In nearly all
2201 cases, the Verdoorn effects obtained for manufacturing or manufacturing sub-sectors
2202 using our CS-ARDL model are lower for manufacturing and manufacturing sub-sectors
2203 than for all sectors as a whole. The only exception here is one estimate of 0.966 when
2204 using real wages. Nonetheless, the question remains why Verdoorn's law seems to be
2205 weaker in the manufacturing sub-sectors as a whole than in the rest of the economy
2206 - even weaker, in fact, than in manufacturing as a whole. This question is even more
2207 important given the fact that these results clash with the ones in the meta-regression
2208 analysis done in chapter I could not find a statistically significant difference in value
2209 for the Verdoorn effect between manufacturing and non-manufacturing either. Given
2210 that the estimates for the manufacturing sub-sectors use more than ten times as many
2211 observations as for manufacturing as a whole, one might lean towards the interpretation
2212 that manufacturing is not the engine of growth anymore (which then raises the question
2213 of what became the new engine instead?). A different interpretation might be that
2214 some deeper structural changes in how European economies work might be responsible
2215 for these results, sub-contracting might disguise manufacturing workers as service
2216 workers. Outsourcing and global value chains might play a role as well. Sadly, the

2217 resulting questions are out of scope of this study and will needed to be treated as
2218 research questions for the future.

2219 Second, our analysis indicates that the Marx-Webb story might have some truth to
2220 it. with some exceptions, most of our estimates of real wage growth or the wage share
2221 are statistically significant. That being the case, the choice of proxy for the Marx-Webb
2222 effect seems to be crucial. While all real wage specifications find positive values, ranging
2223 from 0.193 to 0.315, wage share coefficients are all negative, with one exception.

2224 The negative effect of the wage share on productivity might be because of non-linear
2225 dynamics, as argued by Lima (2004). In his model, a smaller profit share diminished
2226 the motivation to increase labour-saving technology. It does, however, decrease the
2227 available financial funds to innovate as well⁷. Another possible reason might be the
2228 presence of unidentified structural breaks. Economic crises like the ones in 2000 and
2229 2007 use to lead to an increase in the wage share, even though productivity goes down.
2230 While we did control for structural breaks, an unidentified one might lead to unexpected
2231 results.

2232 Chapter II overall finds strong evidence for the existence of the Marx-Webb effect.
2233 Most of our long-run results in our CS-ARDL specification find statistically significant
2234 Marx-Webb effects. The range of this effect ranges from 0.19 across all sectors to
2235 0.32 in manufacturing sub-sectors. An increase in real wages will always have a
2236 favourable effect on productivity growth via this effect, even if there is a negative effect
2237 on productivity growth via the Verdoorn effect. Since we provide ample evidence for
2238 the existence of the Marx-Webb effect, we reflect this in Figure 5 by giving the Marx-
2239 Webb effect in box number 7 a broad, green border, just like we did with the Verdoorn

⁷From a post-Keynesian point of view, this argument is unexpected, as capitalists as a whole can never be finance-constrained.

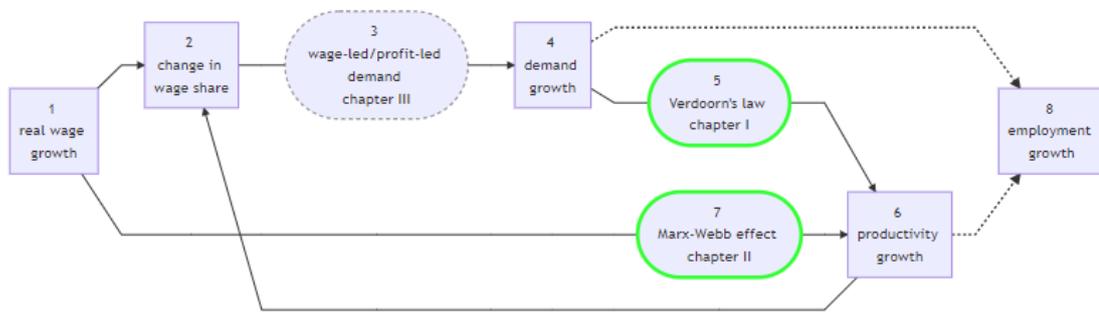


Figure 2.2 – The distribution-productivity-employment nexus, part II:

(a) Based on the present panel data analysis, the Marx-Webb effect is found to be real, with a range between 0.19 and 0.31.

2240 before. The result can be seen in Figure 2.3a. Naturally, the question then arises in
 2241 which cases an increase in real wages should lead to a decrease in aggregate demand
 2242 and, in consequence via Verdoorn's law, to a counteracting influence on productivity
 2243 growth. One explanation for such a case lies in differing demand regimes in different
 2244 countries, for example in the case of a profit-led demand regime. Using meta-regression
 2245 analysis again, in chapter III we will delve into the so-called 'Bhadhuri-Marglin' model
 2246 or 'wage-led/profit-led model' and estimate average marginal effects of a change in
 2247 functional income distribution on demand.

Part III

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How does functional income

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distribution affect growth? - A

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meta-regression analysis of the

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wage-led/profit-led literature

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Chapter 3

A meta-analysis of the wage-led/profit-led literature

3.1 Introduction

1

The economic consequences of shifts in the functional income distribution have recently gained interest as most industrial countries experienced a long-term fall in the wage share beginning in the 1970s up to the Great Recession in 2008 (Guschanski and Onaran 2016; Stockhammer 2017; Karabarbounis and Neiman 2014). The reasons behind the decline of the wage share is a mix of technological change, globalisation, financialisation, and the retrenchment of the welfare state (Stockhammer 2013). Given

¹This chapter is based on a draft that I am currently working on together with Quirin Dammerer (Momentum Institute, Austria), Miriam Rehm (University of Duisburg-Essen, Germany) and Mathias Schnetzer (Austrian Chamber of labour, Austria). Quirin Dammerer and I are responsible for the literature search, the creation of the data set used for the meta-regression as well as control of each others coding work. Miriam Rehm and Mathias Schnetzer are responsible for the econometric estimation as well as in parts for the description of the methodology and the description of the results. All errors in this chapter, of course, are my own.

2264 this shift in the functional distribution, the question arises how the distribution of
2265 national income between profits and wages relates to aggregate demand. The literature
2266 on the relation between functional distribution and GDP growth is commonly referred to
2267 as wage-led versus profit-led demand debate. If an increase in the wage share stimulates
2268 growth, aggregate demand is wage-led and vice versa. While the theoretical arguments
2269 have been exchanged between neo-Kaleckians and neo-Goodwinians, Bhaduri and
2270 Marglin (1990) have proposed a model to conciliate the rival ideas. This model has
2271 motivated a new and rich strand of literature that empirically assesses the nexus between
2272 functional inequality and economic growth, however, the schools of thought have used
2273 the model differently (Stockhammer 2017). This paper provides an overview of this
2274 literature and adds new insights from a meta regression analysis (MRA).

2275 Existing empirical research shows conflicting results for a number of countries
2276 which might also arise from a number of technical factors including variable definitions,
2277 estimation strategies, econometric methods, the choice of control variables, and so forth.
2278 Moreover, these results might underlie publication bias, since editors and referees may
2279 favour findings that are statistically significant, confirm prior beliefs, or are particularly
2280 surprising (Andrews and Kasy 2019). Researchers in turn face strong incentives to
2281 select findings in order to maximise publication chances (Brodeur et al. 2016). Thus,
2282 we conduct a meta regression analysis to study effect sizes in the wage-led/profit-led
2283 literature and to assess the impact of various moderator variables on the dispersion of
2284 elasticities between functional distribution and growth.

2285 We include 34 studies with 494 estimates for total and domestic demand. Our results
2286 suggest that total demand tends to be largely profit-led and domestic demand is mainly
2287 wage-led across all countries. However, there is a small but statistically significant
2288 publication bias for total demand estimations in the direction of a wage-led demand

2289 regime. In contrast, there is little but again statistically significant profit-led publication
2290 bias for domestic demand estimations. We reason that both camps acknowledge research
2291 by the opposite view and might mitigate their results. In addition, our findings reveal
2292 an important impact of different estimation strategies and choice of variables on the
2293 results.

2294 The findings of the wage-led/profit-led literature have important policy implications.
2295 Given the shift in the functional income distribution, countries have adapted their
2296 growth models in order to compensate for the income loss of the labour force. There
2297 is evidence of export-led and debt-led growth models which aim at stabilising growth
2298 through external demand or credit loosening respectively (Behringer and Treeck 2019).
2299 These growth regimes have contributed to the rising current account imbalances prior
2300 to the financial crisis in 2008 and the Euro-crisis thereafter. Thus, the relation between
2301 functional distribution and aggregate demand is of great relevance for economic policy.

2302 The remainder of our paper is structured as follows. We provide an overview of the
2303 wage-led/profit-led debate and its origins in section ???. In section 3.3, we introduce our
2304 data set based on 34 publications and show first descriptive results on the coverage and
2305 direction of the estimates. Section 3.4 presents the results of a meta regression analysis
2306 for total and domestic demand. Finally, section 3.5 draws conclusions from our results
2307 and suggests further research avenues.

2308 3.2 The Bhaduri-Marglin Model - Origins, Current De- 2309 bates and Extensions

2310 The following section is based on parts of my master thesis (List 2015) and the contri-
2311 butions of Lavoie (2017a) and Stockhammer (2017)².

2312 Questions about income distribution and its impact on economic growth long
2313 formed the foundation of what is called classical political economy. Since the rise of
2314 the supply-side paradigm and the displacement of other theories from mainstream
2315 academic debate, not much literature has been published on this 'oldest of topics'.
2316 Income distribution and its possible implications for economic growth are of concern
2317 to some mainstream publications. Yet, inequality was not perceived as something that
2318 needed to be addressed through active policy, but rather taken as a given, due to its role
2319 in standard neoclassical theory. With the occurrence of growing inequality in the US
2320 in the 21st century and the financial crisis from 2007 until the present day, inequality
2321 is back in the mainstream papers. Additionally, Piketty's 2014 perfect timing had an
2322 impact in promoting debate about rising inequality inmidst of the global financial crisis,
2323 the Greek sovereign debt crisis and the Occupy movement. Even though Piketty (2014)
2324 was not too concerned with the implications of the trend towards higher inequality
2325 that he so emphasised, it sparked a new political debate about inequality and its role
2326 in our society. Equally important, it also created the need in international decision-
2327 making institutions such as the International Monetary Fund (IMF) or the OECD for a
2328 theoretical reassessment of its potential impact on economic growth.

²In this section we will focus on the debate concerning *demand* and *productivity* regimes. That is, we discuss the available literature on how both aggregate and productivity react to a change in income distribution. We refrain from going into detail on the question of *employment* regimes

2329 All these events opened up opportunities for heterodox ideas to influence the
2330 discussion within the mainstream, as can be seen for example in Kumhof, Rancière,
2331 and Winant (2015) and Dabla-Norris et al. (2015). However, most mainstream models
2332 still only offer pure supply-side explanations, which is not sufficient to represent the
2333 complexity of capitalism. Post-Keynesian models offer an alternative to mainstream
2334 general equilibrium models. Here, the 'wage-led/profit-led model' proposed by Bhaduri
2335 and Marglin (1990) is commonly used as a benchmark to analyse the impact of changes
2336 in functional income distribution on economic growth.

2337 One aspect that deserves special attention is the different approach of the two
2338 schools of thought presented here. There exists a difference in the methodological
2339 approach, where mainstream analysis emphasises personal income distribution and
2340 post-Keynesian theory emphasises the importance of functional income distribution.
2341 This difference then logically leads to different outcomes in terms of policy proposals.
2342 furthermore, it leads to the question of whether there should not be an interaction
2343 between the two that further influences economic growth, as is proposed by Carvalho
2344 and Rezai (2015). Since in most mainstream publications, inequality tends to be a
2345 problem of inefficient markets or externalities, a viable mainstream solution would be
2346 to have the state intervene to internalise these effects, for example via taxes. Another
2347 option would be to further deregulate financial markets so that no one would have
2348 restricted access to credit and human capital accumulation could be pursued by everyone
2349 if it is their optimal choice. Some mainstream contributions, for example Kumhof,
2350 Rancière, and Winant (2015), argue that this could increase the likelihood of a future
2351 financial crisis. Instead, they would argue for an increase in minimum wages or fiscal
2352 redistribution from high-income groups to low-income groups.

2353 **3.2.1 Income Distribution and Growth in the Mainstream**

2354 Concerning the mainstream discussion on inequality and growth, we want to pay
2355 attention to some aspects that seem especially important to us.

2356 First, almost all of the available literature has focused on the personal rather than the
2357 functional distribution of income when assessing changes in income inequality - with
2358 the exception of Kumhof, Ranci re, and Winant (2015). The reason for this is the use of
2359 methodological individualism in neoclassical and other mainstream theories. After all,
2360 the only kind of income distribution that could matter in an atomistic world populated
2361 by representative agents must be personal income distribution. But overlying these
2362 micro-economic processes are some stronger dynamics that should not be ignored.
2363 Second, for most of the literature it is not so much a change in the distribution of
2364 income itself that has a direct impact on economic growth. Rather, the issue lies in
2365 imperfect markets and/or inefficient public policies. Examples for this are Persson and
2366 Tabellini (1994), Acemoglu et al. (2008), and Ostry, Berg, and Tsangarides (2014). For
2367 this reason, the focus of policy recommendations in mainstream literature does not
2368 lie in re-distributive measures, but rather in (capital) market liberalisation and further
2369 commodification of public services. The aim of this section is therefore to consider
2370 other paradigms that might think of income inequality as a problem in itself. Third,
2371 most theoretical explanations for such a relationship draw their conclusions from an
2372 exclusive supply-side view, ignoring interactions between changes in the distribution
2373 of income and the consequences for effective demand altogether.

3.2.2 Income Distribution and Growth in the (Neo-)Kaleckian Model

In contrast to the mainstream literature, distributional issues are at the centre of the post-Keynesian/(neo-)Kaleckian models. In contrast to the mainstream, however, it is the functional distribution of income that is the focus of attention in the post-Keynesian paradigm. This focus is already present in Keynes (1936) (on the concept of marginal propensity to consume and the idea that it declines as income rises) and can even be found in the work of Kalecki (especially in the assumptions of mark-up prices and excess productive capacity) and Kaldor (assuming an indexation of wages to productivity growth). Starting with the work of Kalecki (1971) and Robinson (1953), the newly emerging post-Keynesian tradition distanced itself from the neoclassical view with its recourse to the concept of effective demand, endogenous money and fundamental uncertainty (Lavoie 2014).

Kaldor (1957) tries to extend the theory of Keynes (1936) from the short to the long run. He also tries to explain what he calls the 'historical constants' of economic growth - these are the constant wage and profit ratio, the constant capital-output ratio and a constant rate of profit. He also assumes full employment in the long run - an assumption that earned him the name 'Jean-Baptiste Kaldor'. Nevertheless, Kaldor (1957) agrees with Keynes (1936) that investment-savings causality runs from the former to the latter, contrary to classical and neoclassical theory.

The following notation of Kaldor's model is taken from Hein (2014) . Since the saving-income ratio in an economy *saving – incomeratio* = $s_W \frac{W}{pY} + s_{\Pi} \frac{\Pi}{pY}$ depends on the weighted average of the marginal propensity to save of wages s_W and profits s_{Π} , any change in the functional income distribution - i. e. i.e. a change in both the wage

2398 share wage share = $\frac{W}{pY}$ and the profit share profit share = $\frac{\Pi}{pY}$ - necessarily provokes
 2399 changes in aggregate saving. As long as the workers' marginal propensity to save
 2400 propensity to save out of wages is smaller than that of the capitalists propensity to
 2401 save out of profits s_W , this relationship holds in Kaldor (1957) model. If one balances
 2402 investment aggregate private investment and saving aggregate private savings (= pI)
 2403 and divides by national income pY , one obtains

$$\frac{pI}{pY} = \frac{S}{pY} = s_W + (s_{\Pi} - s_W) \frac{\Pi}{pY} \quad (3.1)$$

2404 which can be rearranged to obtain the specific profit share π^* to be obtained at
 2405 equilibrium in the goods market.

$$\pi^* = \frac{\Pi}{pY} = \frac{1}{s_{\Pi} - s_W} \frac{I}{Y} - \frac{s_W}{s_{\Pi} - s_W} \quad (3.2)$$

2406 With positive marginal propensities to consume (where s_W is smaller than s_{Π}),
 2407 the profit share π^* - and thus the functional income distribution - is determined by
 2408 investment. The exogenous investment-output ratio investment-output ratio is then
 2409 determined as

$$\frac{I}{Y} = \frac{I}{K} \frac{K}{Y} = g_n \frac{K}{Y} \quad (3.3)$$

2410 where the investment-output ratio $\frac{I}{Y}$ is a function of the natural growth rate 'natural'
 2411 growth rate and the capital-output ratio capital-output ratio (where aggregate capital
 2412 stock is the stock of capital) and must lie between the marginal propensity to save from
 2413 wages s_W and profits s_{Π} .

2414 The other influential tradition of post-Keynesian models was developed by Kalecki

2415 (1971) and Steindl (1976). Kalecki, in particular, deserves mention because he published
2416 his theory of effective demand - the idea that it is the level of aggregate demand at
2417 current prices and incomes that determines the level of output and employment when
2418 aggregate supply is adjusted - three years before John Maynard Keynes. However, as
2419 his studies were originally published in Polish, his work was not recognised until the
2420 1960s, when the first translations into English were published.

2421 Kalecki's background, unlike Keynes', was informed by thorough Marxist studies, in
2422 particular by Rosa Luxemburg's work 'The Accumulation of Capital' (Luxemburg 1963).
2423 In Kalecki's view, capitalist economies are always subject to (productive) overcapacity,
2424 unemployment and monopolies or oligopolies, even in the long run. As Kalecki himself
2425 states: 'In fact, the long-term trend is only a slowly changing component of a chain of
2426 short-period situations; it has no independent unity. [...]' (Kalecki 1971, p.165). The
2427 normal monopolistic or oligopolistic markets mentioned earlier were subject to a price
2428 premium set by the capitalists on the basis of their market power - or their degree of
2429 monopoly, as Kalecki (1971) calls it. As a result, prices become cost-determined, not
2430 demand-determined.

2431 A simple neo-Kaleckian model can be constructed under the following assumptions.
2432 Assuming that workers do not save, their consumption can be written as equal to their
2433 income, i.e. hours worked multiplied by wages received per hour. In other words, their
2434 propensity to consume out of wages propensity to consume out of wages is equal to
2435 100% of aggregate income aggregate output/demand (assuming away the possibility to
2436 indebt themselves). Capitalists, on the other hand, base their consumption propensity
2437 to consume out of profits s_W on an autonomous part plus a part that depends on the
2438 profits aggregate profits received. The core of the neo-Kaleckian model consists in a
2439 partial goods market-equilibrium.

$$C_W = WL = c_W Y$$

$$C_\Pi = a + c_\Pi \Pi$$

2440 Note that the workers' consumption function can be rearranged so that c_W equals
 2441 the wage share $\frac{WL}{Y}$. Assuming that investment is exogenous, in equilibrium aggregate
 2442 expenditure $Y = C + I$ must equal aggregate income $Y = WL + \Pi$. Resulting equilibrium
 2443 profits are thus described by

$$C + I = WL + \Pi$$

$$\Leftrightarrow C_W + C_\Pi + I = WL + \Pi$$

$$\Leftrightarrow WL + a + c_\Pi \Pi + I = WL + \Pi$$

$$\Leftrightarrow a + c_\Pi \Pi + I = \Pi$$

$$\Leftrightarrow \Pi^* = \frac{a + I}{1 - c_\Pi} \quad (3.4)$$

2444 The profits in the aggregate are a residual of wages so that $\Pi = Y - WL$. If we
 2445 equate with equilibrium profits, we can calculate equilibrium income.

$$\begin{aligned}\Pi &= Y - c_W Y = (1 - c_W)Y \\ \Pi &= \Pi^* : \frac{a + I}{1 - c_\Pi} = (1 - c_W)Y \\ \Leftrightarrow Y^* &= \frac{1}{(1 - c_\Pi)(1 - c_W)}(a + I)\end{aligned}\tag{3.5}$$

2446 Differentiating the equilibrium income according to the wage share c_W , we find an
2447 effect of change in the functional income distribution on economic growth:

$$\frac{\partial Y^*}{\partial c_W} = \frac{1}{[(1 - c_\Pi)(1 - c_W)]^2}(a + I) > 0 \text{ for } 0 > c_\Pi > 1\tag{3.6}$$

2448 An increase in the exogenous wage share in a neo-Kaleckian model thus has a posi-
2449 tive endogenous effect on economic growth. The causality between income distribution
2450 and growth runs in the other direction than in the Kaldorian models, in which the
2451 endogenous functional income distribution was determined by exogenous economic
2452 growth. Earlier models by Kalecki (1971) and Steindl (1976) only permitted for positive
2453 growth effects from a rise in the real wage (ex-post termed 'wage-led' growth). Fur-
2454 ther 'Post-Keynesian/Kaleckian models regarding demand regimes and the effect of
2455 income distribution on demand have been formally modelled by Rowthorn (1981), Dutt
2456 (1984), Taylor (1985), Blecker (1989), and Blecker (2011) and extended by Bhaduri and
2457 Marglin (1990)' (Lavoie and Stockhammer 2013b, p.63). Indeed, Bhaduri and Marglin
2458 (1990), also known as the Bhadhuri-Marglin model opened up the possibility for the
2459 converse, 'profit-led' growth, that is, redistribution towards labour income leading to
2460 lower growth.

2461 **The Neo-Goodwinian View on Income Distribution and Growth**

2462 Parallel to the post-Keynesian/(neo-)Kaleckian models, there exists a second group of
2463 models that looks at the intersection between income distribution and economic growth.
2464 This group consists in the neo-Goodwinian models of a more Marxist background.

2465 For neo-Kaleckians, the focus of the analysis rested on the effect of income dis-
2466 tribution on economic growth in the long run, with a special interest in additional
2467 determinants of aggregate demand³. Meanwhile, the neo-Goodwinian literature focused
2468 on the analysis of income distribution and growth during business cycles around a
2469 certain growth path. Additionally, neo-Goodwinians, more so than their Kaleckian
2470 colleagues, were interested in possible feedback effects of economic growth on income
2471 distribution, an effect that would become known as the 'distributive curve' (Lavoie
2472 2017a; Stockhammer 2017).

2473 The classic Goodwin model is a supply-side model which assumes full capacity
2474 utilisation and no demand constraints on growth. Neo-Goodwinians consider the
2475 goods market to be centred around a labour market with an inherent self-adjustment
2476 mechanism. Say's law is supposed to be valid. Thus, savings determine investments,
2477 not the other way around. All wage income is used for consumption and all profits
2478 are used for investment. Hence, a change in income distribution affects growth via a
2479 supply-side channel. An increase in the wage share for example leads to decreases in
2480 investment. The result is a decrease in economic growth, due to a lower increase in
2481 the stock of capital, not due to lower aggregate demand as in neo-Kaleckian models
2482 (Stockhammer 2017, p.29).

2483 Following Marx (1990), a recurring topic in neo-Goodwinian theory is the idea of

³There exist of course studies with stronger emphasis on the short run as well, as for example shown in Lavoie and Stockhammer (2013b)

2484 a profit squeeze, where capitalists' profits are being squeezed between lower profit
2485 rates due to competition and higher wages due to lower unemployment and higher
2486 worker bargaining power (Boddy and Crotty 1975; Weisskopf 1979; Marglin 1984). From
2487 today's standpoint, the argument put forward by this strand of literature would be
2488 called the profit-led story.

2489 **The Bhaduri-Marglin Model**

2490 The role of wages, both as a source of aggregate demand and as part of production costs,
2491 is at the centre of Bhaduri and Marglin (1990). The authors use an IS curve in which,
2492 unlike Keynes (1936), the real wage rate is treated as an exogenous variable rather than
2493 an endogenous one. The authors justify this step with the effect of a change in the
2494 exchange rate, which effectively changes the real wage. Furthermore, they assume a
2495 Kaldorian savings function in which workers have a lower marginal propensity to save
2496 than capitalists. In this way, the authors are able to present the underconsumptionist
2497 argument that redistributing income from capitalists to workers increases aggregate
2498 consumption while reducing aggregate saving. Price formation in the Bhaduri-Marglin
2499 model is covered by a mark-up equation in which firms put a profit margin on their
2500 constant marginal costs - a procedure used mainly in the Kaleckian literature. The
2501 result is a positive relationship between the profit margin and the profit share and a
2502 'distributional conflict between the profit margin/share and the real wage' (Bhaduri
2503 and Marglin 1990, p.378). Thus, an increase in the wage share would have positive
2504 consequences for aggregate consumption, but in certain cases negative consequences
2505 for aggregate investment. Whether total demand increases or decreases therefore
2506 depends on the countries demand-regime.

2507 Thus, assuming that investment is an increasing function of the profit share, an

2508 upward or downward-sloping IS curve can be constructed depending on how sensitive
2509 investment is to a change in the profit share. An economy in which a decline in the wage
2510 share has a negative impact on aggregate demand is called a 'wage-led' economy and
2511 is represented by a downward-sloping IS curve. In such a case, the increase in private
2512 investment is not strong enough to make up for the decrease in private consumption.
2513 Conversely, if private investments react stronger than private consumption, a fall in the
2514 wage share has an expansionary effect and the economy is considered to be *profit-led*,
2515 which is represented by an upward-sloping IS curve.

2516 The Bhaduri-Marglin model can thus represent both the neoclassical/Marxist notion
2517 of a profit-driven expansion through an increase in the profit share and the under-
2518 consumptionist view. The authors state: '*The 'two paths to output expansion' proposed*
2519 *by Keynes are analytically linked in our model by exogenous variation in the real wage*
2520 *and the distribution of income across classes'* (Bhaduri and Marglin 1990, p.379). It is
2521 also striking that the authors explain their investment function in terms of the profit
2522 margin rather than the rate of profit. This places them in a Kaleckian rather than a
2523 Robinsonian tradition, since the latter does not take into account the variability of
2524 capacity utilisation (Stockhammer 2004, pp.35-39).

2525 Bhaduri and Marglin (1990) also point out that while they consider a distributional
2526 struggle between workers and capitalists possible, a lower profit share for the capitalists
2527 does not necessarily mean a loss of absolute profits for the capitalist class: '*Capitalism is*
2528 *not necessarily a zero-sum game'* (Bhaduri and Marglin 1990, p.382). So one could think
2529 about cooperative relations between workers and capitalists, both in wage-controlled
2530 and profit-controlled countries. These cooperative regimes can only exist if investors
2531 are more responsive to a variation in capacity utilisation than to a variation in the profit
2532 rate (Bhaduri and Marglin 1990, p.373). However, these cooperative regimes may run

2533 into difficulties in the long run. The wage-led regime could lead to an intra-capitalist
2534 struggle over profits in the medium term, while in the long run it creates an under-
2535 accumulation crisis leading to structural unemployment (ibid.). Such a growth strategy
2536 would therefore have to be restrained so that the difference between productivity
2537 growth and real wage growth does not become too large. The profit-oriented regime, on
2538 the other hand, implies very similar conclusions. In the medium term, a profit-oriented
2539 cooperative regime could lead to tensions within the working class, similar to the New
2540 Keynesian insider-outsider models, where the distributional struggle between workers
2541 and capitalists turns into a distributional struggle within the workforce. In the long run,
2542 such a regime runs the risk of entering an overaccumulation/underconsumption crisis
2543 in the Marxian sense. Moreover, as productivity grows faster than real wages, capitalists
2544 may have problems finding enough workers to utilise the increased capital stock, which
2545 in turn could lead to intra-capitalist tensions over available workers (Bhaduri and
2546 Marglin 1990, p.383-84).

2547 The Bhaduri-Marglin model can be seen as a synthesis of both the neo-Goodwinians
2548 and neo-Kaleckian schools to combine different possible outcomes. A cooperative policy
2549 in a wage-led economy, which consists of real wages growing along with productivity
2550 increases, is close to neo-Kaleckian theory and is in fact what many European countries
2551 experienced between the 1940s and 1970s. This changed with the advent of neo-
2552 liberalism, which promoted a world of high growth based on profit increases and the
2553 resulting trickle-down effect (Lavoie and Stockhammer 2013a, p.41). The contradictory
2554 political regimes eventually lead to economic crisis, which according to Marx is inherent
2555 in capitalism. A prolonged policy of wage growth over productivity in a wage-driven
2556 economy leads to a crisis of under-accumulation in a conflictive regime. The Marxian
2557 crisis of under-accumulation will erupt in a profit-driven regime when real wage

2558 growth is kept below productivity growth for a considerable period of time. The
2559 introduction of the foreign sector into Bhaduri and Marglin (1990) leads us to somewhat
2560 different conclusions about the nature of the different regimes. Here, devaluation in
2561 a profit-driven regime has a clearly expansionary effect, whereas this is not so clear
2562 in a wage-driven regime. A domestically wage-led economy can take on a profit-led
2563 character when trading with the rest of the world if the trade effect becomes dominant
2564 (Bhaduri and Marglin 1990, p.388). Thus, a country could switch from a (domestic)
2565 wage-led cooperative regime to an (open economy) profit-led conflictive regime and
2566 experience fairly stable economic growth for some time. However, as the authors note,
2567 'it is impossible for all countries to achieve a trade surplus at the same time' (ibid.).
2568 This argument connects to the one made by Onaran and Galanis (2012), namely that
2569 the world as a whole must necessarily be wage-driven. This is also of concern to
2570 Lavoie and Stockhammer (2013a, pp. 14-15, 19-21). The implication is the possible
2571 (symbiotic) existence of export-led and debt-led countries. For Lavoie and Stockhammer
2572 (2013a), this is a possible explanation for the supposed 'success' of neo-liberalism, profit-
2573 driven growth despite wage-led regimes. According to the authors, neo-liberalism
2574 has produced these two ultimately unsustainable regimes by creating increased and
2575 deregulated financial markets to promote higher - but ultimately unsustainable - growth,
2576 with the current economic crisis as a direct consequence (Lavoie and Stockhammer
2577 2013a, p.24).

2578 There is however a difference in scope that the Bhadhuri-Marglin model gets at-
2579 tributed by neo-Kaleckians and neo-Goodwinians, as explained by Stockhammer (2017).

2580 *For the neo-Kaleckians¹ the Bhaduri–Marglin is a generalisation of the wage-*
2581 *led Kaleckian model. Kaleckians interpret the effects identified as partial-*

2582 *equilibrium, medium-term goods markets effects. The context in which the*
2583 *Bhaduri–Marglin model is used is best illustrated with respect to Keynes’s dis-*
2584 *ussion of the effect of wage cuts on employment in chapter 19 of The General*
2585 *Theory (Keynes 1973). [...] For the neo-Goodwinians, the Bhaduri–Marglin*
2586 *model has allowed a generalisation of the Goodwin model, which is a business*
2587 *cycle model. The original Goodwin model is a supply-side model of distribu-*
2588 *tional cycles that assumes that Say’s law holds: capacity is fully utilised and*
2589 *there are no demand constraints on output (Goodwin 1967). (Stockhammer*
2590 *2017, pp.28-29)*

2591 Neo-Kaleckians use the Bhadhuri-Marglin model as a growth model and are more
2592 interested in partial equilibrium goods market analysis. For them, the important part is
2593 the effect of a change in functional income distribution on the components of aggregate
2594 demand, consumption, investment and net exports - and, as a result of the partial
2595 effects, economic growth as a whole. On the other hand, neo-Goodwinians use the
2596 Bhadhuri-Marglin model as a business cycle model. Neo-Goodwinians also emphasise
2597 feedback effects back from economic growth on distribution, while the effects of income
2598 distribution on demand components are of secondary importance. The use of so-
2599 called 'distribution functions' is therefore much more frequent in the neo-Goodwinian
2600 literature on the Bhadhuri-Marglin model.

2601 These differences in interpretation concerning the Bhadhuri-Marglin model have
2602 direct consequences for econometric estimation. Neo-Kaleckians estimate the Bhadhuri-
2603 Marglin model by estimating the marginal effects of a change in income distribution on
2604 consumption, investment and net exports in three different equations (we call this the
2605 additive approach). The marginal effect itself contains the mean values of the variables

2606 used for its estimation. Many studies therefore additionally use alternative mean values
2607 as controls (for example the value of the first and/or last year in the data set). The
2608 overall effect of a change in the wage share/profit share on economic growth is then
2609 given by the sum of the three partial effects. In some papers, a Keynesian multiplier is
2610 estimated as well and used together with the partial effects to obtain the final effect
2611 on economic growth. An advantage of this approach is the possible separation of
2612 domestic demand, consisting in the effects of income distribution on consumption
2613 and investment, and total demand, which is the sum of domestic demand plus the
2614 effect of income distribution on net exports. In tendency, consumption is found to
2615 be wage-led while net exports are found to be profit-led, with investment being the
2616 demand component most like to differ across countries. Countries with big domestic
2617 markets are usually found to be wage-led while smaller countries with a high share of
2618 imports and/or exports are found to be profit-led. As was already argued by Lavoie and
2619 Stockhammer (2013b), however, the world as a whole is likely to be wage-led. In this
2620 case, a world-wide increase in the wage share would benefit even countries under a
2621 profit-led demand regime.

2622 The distinction between domestic demand and total demand can shed more light
2623 in the main drivers of a countries respective demand regime. As a result, policy rec-
2624 ommendations might dramatically change depending on which demand component
2625 is found to be wage-led/profit-led. We will call this the 'additive approach' from now
2626 on⁴ Neo-Goodwinians however estimate only a single reduced-form demand equation
2627 in the majority of all studies. Often they add another equation for the distribution
2628 function, however. We will call this approach the 'simultaneous approach' from now
2629 on.

⁴This type of estimation methodology is often called 'single equations estimation'.

3.3 Data

In order to compile our meta-data set, we comprehensively sampled JSTOR, EconLit, RePEc, and Google Scholar databases for publications empirically estimating the relationship between the functional income distribution and growth, which do not (implicitly) assume decreasing marginal returns of firms, also known as the "wage-/profit-led debate". In our search, we used the central keywords "wage-led", "wage-led growth", "wage-led regime". All search phrases were repeated for profit-led, and without hyphen. We also searched for "stagnationist" and "exhilarationist", the terms for wage- and profit-led growth used in the older literature, and for "Goodwin cycle" (also with hyphen), which sometimes denotes profit-led growth. Furthermore, we snowballed from the surveys of the literature in Stockhammer and Onaran (2013), Lavoie and Stockhammer (2013b), Hein (2014), Yilmaz (2015), Lavoie (2017a), Álvarez, Uxó, and Febrero (2019), Oyvat, Öztunalı, and Elgin (2018), and Stockhammer, Rabinovich, and Reddy (2018) and included the papers citing the seminal paper by Barbosa-Filho and Taylor (2006). Studies published after October 1st, 2019 were excluded.

The consistent effect measured for our analysis is the marginal effect of the wage share on growth. For papers measuring the functional distribution as the profit share, we invert the estimates by multiplying them by -1 , since the profit share is by definition the inverse of the wage share. To be included in our data set, studies must report (1) the marginal effect of the wage (or profit) share on (total or domestic) growth, (2) the standard error or at least the number of observations (or make it possible to compute the latter).

In estimating these marginal effects, the literature uses either additive or simultaneous estimation strategies. The former estimates the following equation:

$$g = f(d, X), \quad (3.7)$$

2654 where g is some measure of growth, d is the functional income distribution (typically
 2655 the wage share), and X is a vector of controls. In the additive strand of the literature,
 2656 the channels through which distribution affects growth are often estimated explicitly
 2657 in a two-stage approach:

$$g = f(y, X)$$

$$y = f(d),$$

2658 where y are typically measures of domestic and/or external demand (that is, private
 2659 or government consumption and investment, imports, and exports). For simultaneous
 2660 estimations, papers are included when they report the marginal effects of the equations:

$$\dot{g} = f(g, d, X) \quad (3.8)$$

$$\dot{d} = f(g, d, X).$$

2661 We sample all marginal effects reported in individual primary studies, that is, we
 2662 do not sample selectively. This yields our database comprising 218 estimates for total
 2663 demand and 276 estimates for domestic demand from 34 studies. Our total number
 2664 of 494 observations is thus somewhat above the average 400 estimates reported by
 2665 Ioannidis, Stanley, and Doucouliagos (2017) for meta analyses.

2666 The variables covered, their definitions, mean and standard deviation are presented
 2667 in Table 3.1. The dependent variables are the marginal effect between the functional

2668 income distribution and either total or domestic growth (that is, the change in private
2669 consumption plus investment). We group control variables into estimation methods,
2670 meta-regression controls for time and space, controls used by the studies in the in-
2671 vestment or net export functions, and controls for government and inequality. All
2672 meta-regression controls are coded as dummies, where 0 is defined as the "best case"
2673 wherever possible.

2674 Estimation methods include whether the study was published recently and whether
2675 it is unpublished, both of which may allow for lower quality control. It also covers
2676 whether the study uses estimations other than least squares, whether the estimation
2677 method is simultaneous (rather than additive), whether the data is quarterly, whether
2678 the dependent variable is capacity utilisation (rather than GDP growth), and whether
2679 real wages (rather than wage or profit share) are used to measure the functional income
2680 distribution.

2681 Meta-regression controls of time and space attempt to control for potential changes
2682 in regimes – that is, whether economies were more wage- or profit-led at a certain
2683 point in time – by controlling for an "early observation period", i.e. whether the
2684 average year of the period covered in the estimates is before 1990. We also control for
2685 possible differences between higher- and lower-income regions by including dummies
2686 for whether a country is non-OECD, and whether it is located in a low-income region.

2687 Finally, two blocks of controls take the covariates of the studies covered in our
2688 meta-regression into account, which may approximate their quality. These are whether
2689 the investment and export functions include controls for demand and profits (including
2690 gross profits), and the interest rate; and whether the export function controls for demand,
2691 profits (again including gross profits), competitiveness, and the exchange rate. Second,
2692 we control for studies' government and inequality covariates. These include public

Table 3.1 – Meta-Regression Variable Definitions

	Description	Mean	S.D.
<i>Dependent variable</i>			
Effect size (total)	Marginal effect between the functional income distribution and growth (change in private consumption and investment, and net exports)	-0.177	0.52
Effect size (domestic)	Marginal effect between the functional income distribution and domestic growth (change in private consumption plus investment)	0.265	0.51
<i>Estimation methods</i>			
Recent publication	D = 1: Study published in the past 5 years (after 2014)	0.408	0.49
Unpublished	D = 1: Study not published in peer-reviewed journal	0.255	0.44
Non-LS	D = 1: Estimation strategy is not standard least squares (LS) regression	0.810	0.39
Simultaneous estimation	D = 1: Simultaneous estimation (D = 0: Additive estimation)	0.195	0.40
Quarterly data	D = 1: Estimate is based on quarterly data	0.465	0.50
Capacity utilization	D = 1: Dependent variable is capacity utilization (D = 0: GDP)	0.062	0.24
Real wages	D = 1: Real wages are used as measure of functional distribution	0.042	0.20
<i>Meta-regression controls for time and space</i>			
Early observation period	D = 1: Average year of observation period is before 1990	0.771	0.42
Non-OECD	D = 1: Estimate is for non-OECD country	0.167	0.37
Low-income region	D = 1: Estimate is for a country or a region in Africa, South America, or Asia	0.224	0.42
<i>Studies' controls in investment (I) or net export (X) functions</i>			
Demand (in I)	D = 1: Estimation does not control for demand in I function	0.014	0.12
Profits (in I)	D = 1: Estimation uses no or gross profits as control in I function (D = 0: profit share or profit rate)	0.142	0.35
Interest rate (in I)	D = 1: Estimation does not control for interest rate in I function	0.813	0.39
Demand (in X)	D = 1: Estimation does not control for demand in X function	0.442	0.50
Profits (in X)	D = 1: Estimation does not control for profits in X function	0.739	0.44
Competitiveness (in X)	D = 1: Estimation does not control for competitiveness in X function	0.663	0.47
Exchange rate (in X)	D = 1: Estimation does not control for the exchange rate in X function	0.754	0.43
<i>Studies' controls for government and inequality</i>			
Public investment	D = 1: Estimation does control for public investment	0.915	0.28
Government spending	WORK-IN-PROGRESS as of 4th July, 2021 D = 1: Estimation does not control for government spending	0.810	0.39
Financialization	D = 1: Estimation does not control for measure of financialization	0.671	0.47
Personal inequality	D = 1: Estimation does not control for measure of personal inequality	0.748	0.43
Wealth inequality	D = 1: Estimation does not control for measure of wealth inequality	0.768	0.42

2693 investment, government spending, financialisation, personal inequality, and wealth
 2694 inequality.

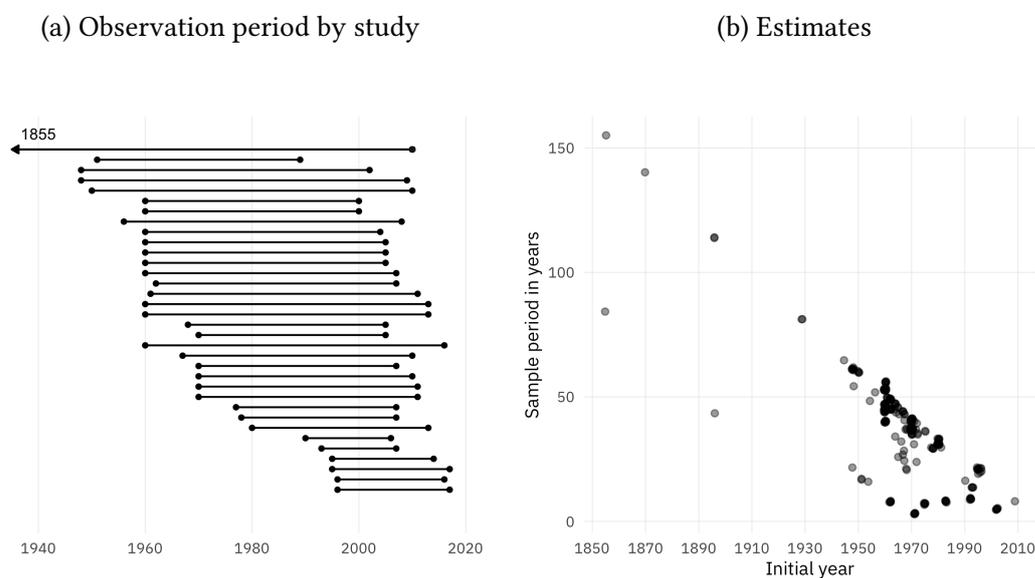


Figure 3.1 – Start year and sample period of estimates and studies

2695 The estimates in our database cover a time span of 164 years, as Figure 3.1a shows.
 2696 While most of the 34 studies use data beginning in the 1960s, one article relies on data
 2697 going back to the 19th century for the UK, France, Germany, and the US (Stockhammer,
 2698 Rabinovich, and Reddy 2018). The distribution of initial years and sample periods
 2699 for the individual estimates is shown in Figure 3.1b. Most estimates are based on an
 2700 observation period of around 50 years beginning between 1960 and 1970. Only a few
 2701 estimates include very long-term data and some studies provide estimates for rather
 2702 short periods starting in the 1990s, as can be seen in the right-hand side panel of Figure
 2703 3.1b.

2704 The studies in our sample cover a wide regional variation. In total, there are
 2705 estimates for 57 countries and regions in our database. Figure 3.2 shows that most

2706 research focuses on Europe and the United States, but Latin America, South and South-
 2707 East Asia, and the Middle East are also covered. The most notable global gaps are Africa
 2708 and the former Soviet Union where almost no estimates are available. There is thus a
 2709 remarkable overhang of estimates for OECD (83%) versus non-OECD (17%) countries.

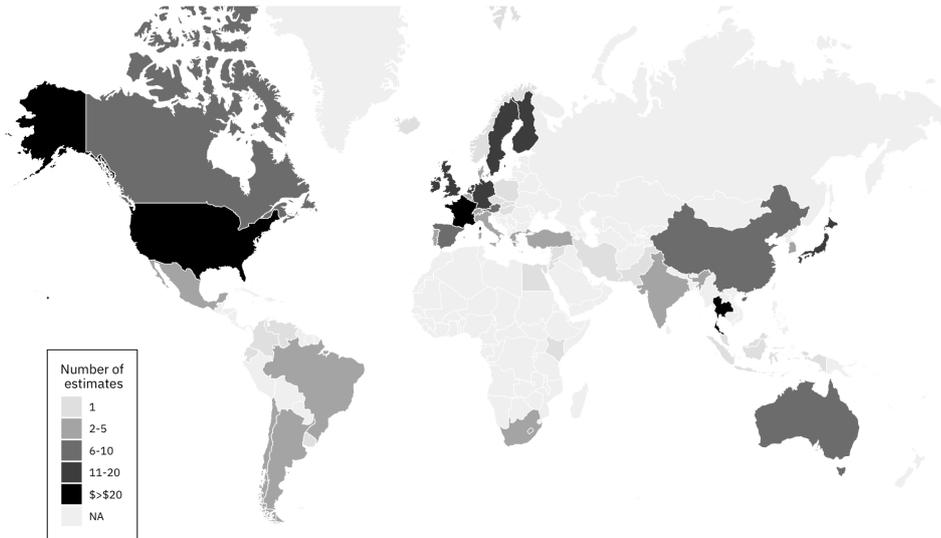


Figure 3.2 – Countries covered by our database

2710 Finally, Figure 3.3 shows the distribution of effect sizes for total and domestic demand.
 2711 The distribution for total demand is somewhat left-skewed, with more estimates that
 2712 imply a negative relationship between redistribution towards wages and growth. The
 2713 sample mean for all estimates (-0.177) given in Table 3.1 supports this observation.
 2714 The bulk of estimates clusters around zero with only small positive or negative effects.
 2715 In contrast, there is one notable outlier with a very large positive effect for Norway
 2716 1962–2011 (Oyvat, Öztunalı, and Elgin 2018). For domestic demand, the histogram
 2717 shows a right-skewed distribution of estimates. The figure suggests that domestic
 2718 demand is rather wage-led with a sample mean of 0.265 across all studies.

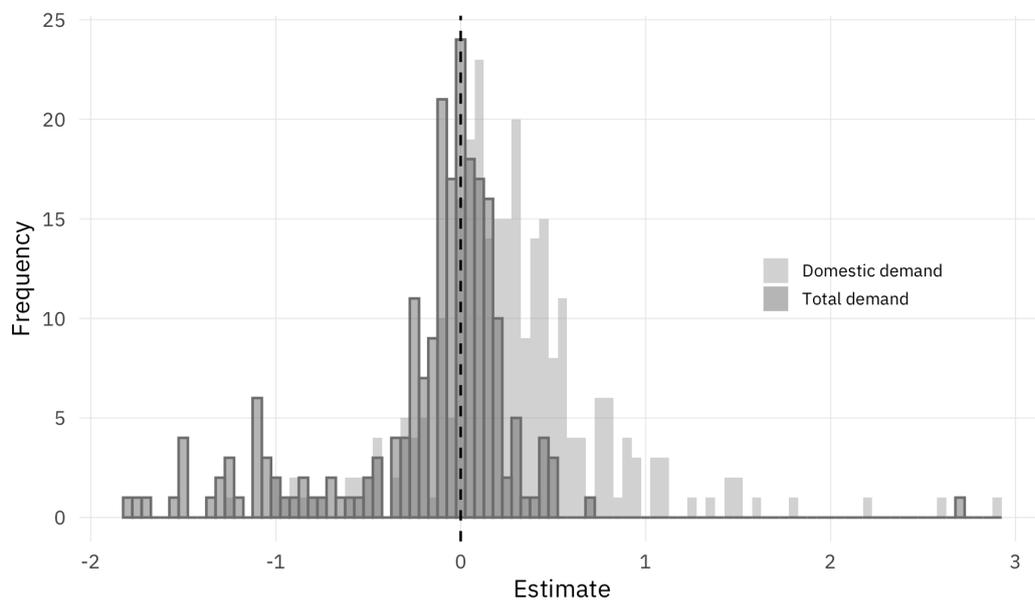


Figure 3.3 – Histogram of estimates for total and domestic demand

2719 **3.4 Results**

2720 We first focus on the effects of functional inequality on total demand. Figure 3.4 shows
2721 the funnel plot of estimated effect sizes. As a significant number of papers do not provide
2722 standard errors for the estimates, (Stanley and Doucouliagos 2012) suggest to use the
2723 square root of the number of observations as an alternative measure of precision. While
2724 less accurate than the standard error, the square root of the sample size is considered a
2725 feasible proxy for precision in the literature (Begg and Berlin 1988; Rosenberger and
2726 Stanley 2009). This method promotes studies with a very large number of underlying
2727 observations like the paper by Kiefer and Rada (2015) that uses quarterly data for a
2728 period of 40 years and 13 OECD countries. Another study is based on 34 countries and
2729 an observation period of 41 years (Hartwig 2014). The figure shows those estimates with
2730 a higher precision, or a large number of observations respectively, centering around
2731 zero. Since estimates at the bottom obtain lower precision, they are widely dispersed.
2732 In contrast, the more precise estimates are more compactly distributed (Stanley and
2733 Doucouliagos 2012). As can be seen, there is a notable overhang in the negative area
2734 (59%) indicating a profit-led total demand. Nevertheless, there is a considerable number
2735 of estimates above zero (41%). The lack of symmetry in the funnel plot is a first indication
2736 of publication bias.

2737 In a next step, we conduct meta regression analysis to identify potential publica-
2738 tion bias. Typically, meta regression analysis involves FAT-PET (funnel-asymmetry
2739 precision-effect test) and PEESE (precision-effect estimate with standard error) regres-
2740 sions. These models regress the effect size on measures of precision and a set of control
2741 variables. The rationale is that the reported effect is positively correlated with its
2742 standard error when publication selection is present. The coefficient of the precision

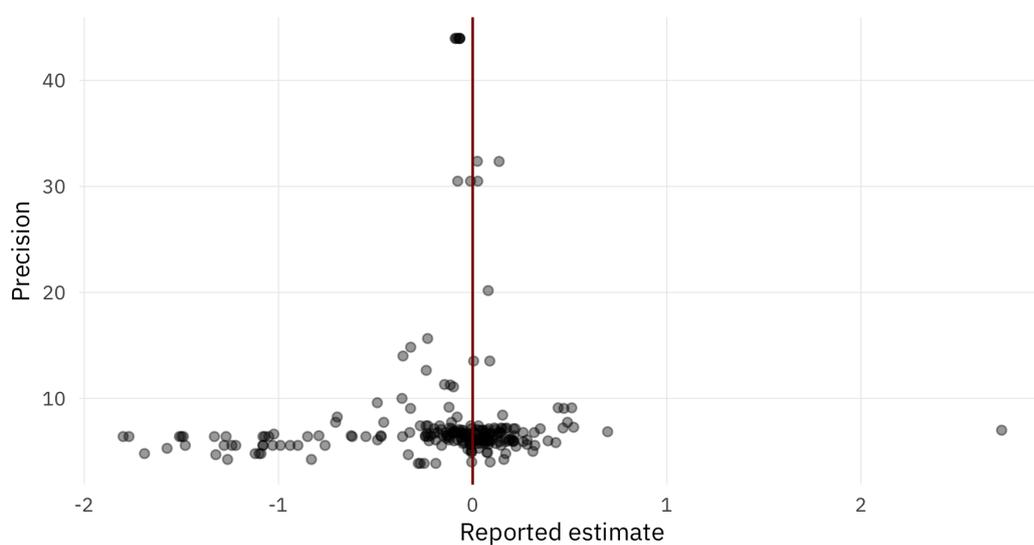


Figure 3.4 – Funnel plot: Total demand

2743 measure thus models publication bias, while the coefficient for the intercept serves
 2744 as corrections for publication bias (Stanley and Doucouliagos 2012). The difference
 2745 between FAT-PET and PEESE regressions is that the former uses the standard error and
 2746 the latter takes the variance, i.e. squared standard errors. It has to be noted that the
 2747 error term in such regressions is not expected to be i.i.d. and thus weighted least squares
 2748 (WLS) is routinely employed. This way, more weight is assigned to those estimates
 2749 with more precision. Finally, we perform stepwise model selection by using the Akaike
 2750 information criterion (AIC) and keep the statistically significant covariates only.

2751 Table 3.2 contains our regression results for total demand. We add moderator
 2752 variables in blocks as described above and conduct FAT-PET and PEESE regressions
 2753 with the root of the number of observations as measure of precision. In general, we
 2754 do find a small publication bias but surprisingly in favour of wage-led coefficients,
 2755 as is indicated by the positive coefficient for the precision measures. The negative

Table 3.2 – Regression results: Total demand

	<i>Dependent variable:</i>					
	Marginal effect b/w functional distribution and growth					
	FAT-PET	PEESE	FAT-PET	PEESE	FAT-PET	PEESE
	(1)	(2)	(3)	(4)	(5)	(6)
Precision	0.009*** (0.002)		0.016*** (0.003)		0.007*** (0.002)	
Number of observations		0.0002*** (0.00004)		0.0003*** (0.00005)		0.0001*** (0.00003)
Recent publication	-0.150** (0.063)	-0.183*** (0.067)				
Unpublished			-0.127 (0.083)	-0.129 (0.088)	-0.249*** (0.063)	-0.286*** (0.062)
Non-LS	0.578*** (0.081)	0.609*** (0.080)	0.418*** (0.082)	0.522*** (0.097)		
Simultaneous estimation	0.172** (0.069)	0.166** (0.068)	0.281*** (0.072)	0.227** (0.096)	-0.189*** (0.055)	-0.171*** (0.057)
Quarterly data	0.155* (0.080)	0.132 (0.082)	0.164 (0.113)	0.181 (0.111)	0.340*** (0.102)	0.351*** (0.110)
Real wages	0.318*** (0.117)	0.329*** (0.114)		0.246* (0.141)		
Capacity utilization			-0.506*** (0.130)	-0.352** (0.177)	-0.559*** (0.118)	-0.592*** (0.128)
Early observation period			0.236*** (0.075)	0.223*** (0.073)		
Non-OECD			-0.265*** (0.052)	-0.192*** (0.066)	-0.267*** (0.042)	-0.250*** (0.044)
No personal inequality					-0.608*** (0.091)	-0.608*** (0.095)
No wealth inequality					0.890*** (0.078)	0.911*** (0.081)
Constant	-0.657*** (0.098)	-0.595*** (0.095)	-0.691*** (0.092)	-0.682*** (0.103)	-0.272*** (0.101)	-0.226* (0.117)
Observations	218	218	218	218	218	218
Method	X	X	X	X	X	X
Time/Space			X	X	X	X
Controls					X	X

Note:

*p<0.1; **p<0.05; ***p<0.01

2756 coefficient for the constant suggests that the effect size would be even more negative
2757 when corrected for publication bias. These results imply that total demand in an overall
2758 perspective is largely profit-led.

2759 Among the moderator variables, we find some consistent coefficients across the esti-
2760 mations. For instance, results for total demand are more profit-led when estimations use
2761 capacity utilisation rather than GDP, when studies are not published in peer-reviewed
2762 journals, and when the observed country is not an OECD member. In contrast, using
2763 quarterly data, taking real wages as measure of functional distribution, and applying
2764 other methods than standard least squares regression tend to generate more wage-led
2765 results. The inequality variables, however, are not conclusive. While the absence of
2766 personal income inequality measures is rather present in papers that find profit-led total
2767 demand, the exclusion of wealth inequality is associated with more wage-led results.
2768 Interestingly, the coefficients for simultaneous rather than additive estimation strategy
2769 turns negative when including all control variables. Thus, simultaneous estimation
2770 strategies are rather associated with profit-led total demand. Other controls like the
2771 inclusion of measures for public investment, government spending, and financialisation
2772 do not show statistically significant effects in either direction.

2773 Turning to the relationship between functional inequality and domestic demand,
2774 figure 3.5 provides the funnel plot of all effect sizes. Previous literature studies have
2775 shown that a majority of countries feature wage-led domestic demand (Stockhammer
2776 and Onaran 2013; Stockhammer 2017). The funnel plot supports these findings as the
2777 reported estimates for domestic demand are largely above zero. In fact, some 79% of all
2778 estimates are above and only 21% of estimates are below zero. Moreover, also the more
2779 precise estimates feature wage-led domestic demand. However, the funnel plot looks
2780 much more symmetric around the sample mean, indicating a smaller publication bias

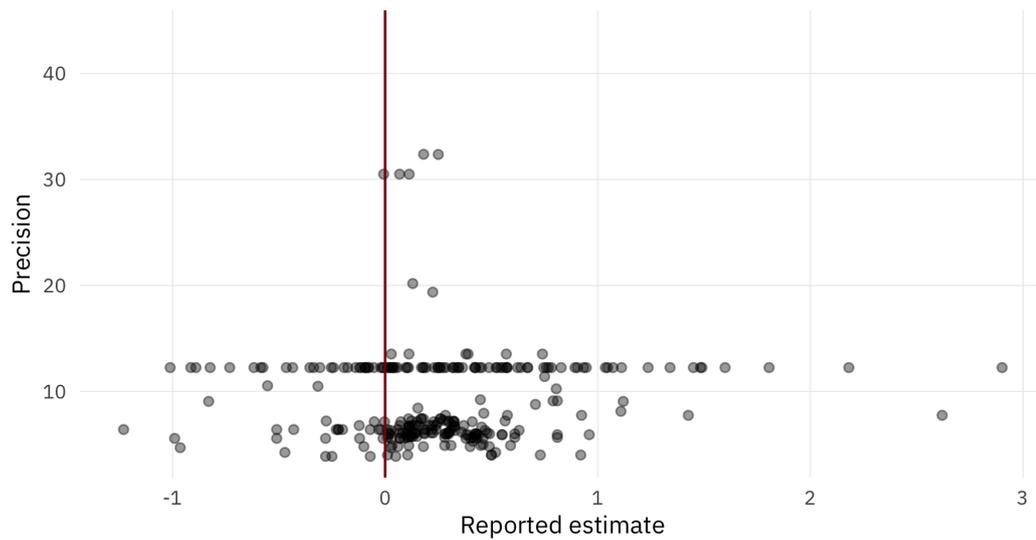


Figure 3.5 – Funnel plot: Domestic demand

2781 than for total demand.

2782 Table 3.3 presents our regression results for domestic demand. Again, only statisti-
 2783 cally significant results are kept due to the stepwise estimation strategy. With respect to
 2784 our precision measure, the FAT-PET model only shows publication bias in specification
 2785 (5). We find a small profit-led publication bias that is also present in all the PEESE
 2786 specifications. When correcting for publication bias, the estimates would be even more
 2787 wage-led, as the positive coefficients for the constant suggest. However, the wage-led
 2788 correction is considerably smaller than the profit-led correction for total demand. Some
 2789 covariates help explain the variation in the effect sizes. For instance, using methods
 2790 other than standard least squares regression and simultaneous estimation positively
 2791 correlate with the effect size. Estimates for non-OECD countries are more profit-led
 2792 than for OECD countries. The controls in the net export function yield opposing results.

2793 To sum up the results from the meta regression analysis, we find small but sta-

Table 3.3 – Regression results: Domestic demand

	<i>Dependent variable:</i>							
	Marginal effect b/w functional distribution and growth							
	FAT-PET	PEESE	FAT-PET	PEESE	FAT-PET	PEESE	FAT-PET	PEESE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Precision					−0.017*** (0.005)			
Number of observations		−0.0004*** (0.0001)		−0.0004*** (0.0001)		−0.0005*** (0.0001)		−0.0005*** (0.0001)
Non-LS		0.285*** (0.087)		0.285*** (0.087)				
Simultaneous estimation		0.614*** (0.149)		0.614*** (0.149)	0.620*** (0.169)	0.652*** (0.176)	0.238** (0.103)	0.652*** (0.176)
Quarterly data	0.162** (0.066)							
Capacity utilization		−0.814 (0.717)		−0.814 (0.717)	−0.834 (0.735)	−0.893 (0.740)		−0.893 (0.740)
Early observation period							0.267*** (0.062)	
Non-OECD			−0.297*** (0.054)					
No demand (in X)					0.323*** (0.068)	0.279*** (0.065)		0.279*** (0.065)
No exchange rate (in X)					−0.300*** (0.091)	−0.300*** (0.092)		−0.300*** (0.092)
Constant	0.176*** (0.031)	0.091 (0.070)	0.316*** (0.043)	0.091 (0.070)	0.509*** (0.115)	0.425*** (0.092)	0.059* (0.036)	0.425*** (0.092)
Observations	276	276	276	276	276	276	276	276
Method	X	X	X	X	X	X	X	X
Time/Space			X	X	X	X	X	X
Controls in I/X					X	X	X	X
Controls							X	X

Note:

*p<0.1; **p<0.05; ***p<0.01

2794 tistically significant publication bias in the wage-led/profit-led literature. However,
2795 the direction of the publication bias is surprising. For total demand, where published
2796 results largely point to profit-led effects, the publication bias is wage-led. This means
2797 that the results are even more profit-led when accounting for this bias. In contrast,
2798 the publication bias for domestic demand indicates that the effects would be even
2799 more wage-led than they actually are. In general, our results bolster the evidence from
2800 existing literature reviews that generally find domestic demand to be wage-led and
2801 total demand to be profit-led. This conforms to the view that smaller and more open
2802 economies tend to be profit-led. While there are country-specific idiosyncrasies and
2803 some studies in our sample even find opposing results for the exact same countries, our
2804 findings give a general intuition of the relationship between functional inequality and
2805 economic growth as provided by the literature.

2806 **3.5 Conclusion**

2807 This paper has analysed the current state of the empirical literature on the relationship
2808 between functional distribution and economic growth. The theoretical arguments of
2809 this strand of literature mainly origin from a controversy between post-Kaleckians and
2810 post-Goodwinians. If a rise in the wage share benefits growth, the demand regime is
2811 called wage-led and profit-led otherwise. As these theories promote opposing views,
2812 empirical studies tried to shed more light on the demand effects of shifts in the func-
2813 tional distribution. A cursory finding of literature reviews is that in many small open
2814 economies, domestic demand is wage-led and total demand is profit-led.

2815 We review 34 studies with almost 500 empirical estimates for domestic and total
2816 demand and conduct a meta regression analysis to systematically assess the literature.

2817 We support previous findings that a general survey of the literature results in wage-led
2818 domestic demand and profit-led total demand. While there are naturally country-specific
2819 idiosyncrasies, our results for a large set of countries provide a general intuition of the
2820 mechanisms between the wage share and growth. Concretely, it indicates consumption
2821 and investment to be overly wage-led, and incorporating net exports mostly turning
2822 results profit-led. In this sense, our results coincide more with the neo-Goodwinian
2823 literature than the neo-Kaleckian.

2824 We find little but statistically significant publication bias in this strand of literature.
2825 Surprisingly, the publication bias points to the opposite direction of the results. Thus,
2826 total demand would be even more profit-led and domestic demand would be even more
2827 wage-led when taking publication bias into account. These results are robust with
2828 respect to FAT-PET or PEESE regressions. We identify several methodological and
2829 moderator variables that are able to explain a share of the variation in the empirical
2830 estimates. For instance, results for total demand are more profit-led when estimations
2831 use capacity utilisation rather than GDP, when studies are not published in peer-
2832 reviewed journals, and when the observed country is not an OECD member.

2833 While this paper aims at summarising what we know about the relation between
2834 functional distribution and growth, these insights might also be of interest for economic
2835 policy. The long-term fall in the wage shares in many industrialised countries has
2836 entailed challenges to stabilise aggregate demand. While some countries have been
2837 able to increase their international competitiveness and pursue a export strategy, others
2838 have compensated falling wage shares with a rise in private debt-levels to maintain
2839 demand. Particularly prior to the financial crisis in 2008, this has led to unsustainable
2840 current account balances and was a contributory cause of the crisis (Behringer and
2841 Treeck 2019). Thus, the relation between functional distribution and growth should be

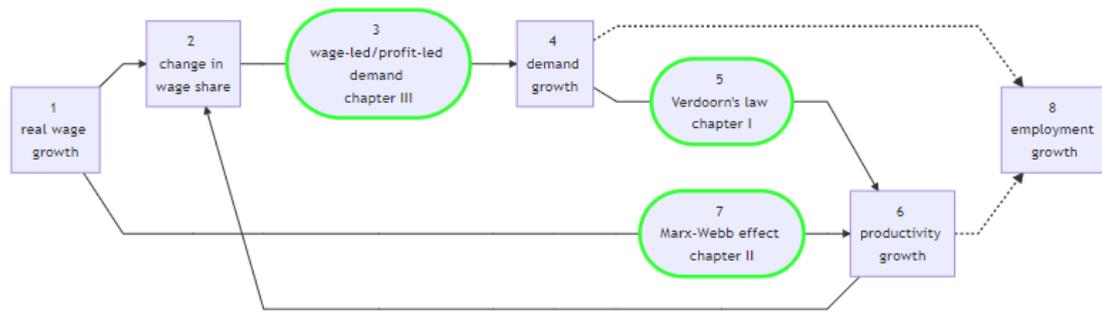


Figure 3.6 – The distribution-productivity-employment nexus, part III:

(a) Based on the present meta-regression analysis, there is a clear link between functional income distribution and aggregate demand. In the case of total demand, the average economy is found to be profit-led, with a meta-average of -0.6 . This finding does not take into account that the world as a whole needs to be wage-led.

2842 key for policy makers with a focus on economic stability.

2843 In this chapter, we gave a thorough overview of the literature on the Bahdhuri-
 2844 Marglin model, commonly known as the 'wage-led/profit-led' model. We did so using
 2845 yet again meta-regression analysis as our method. Our results of the average country
 2846 being profit-led can be directly transferred to our model in Figure 5. Figure 3.7a thus
 2847 puts the demand regime in box number 3 in broad, green borders. With this chapter,
 2848 we did provide ample evidence for all three economic effects present in the model: first
 2849 the Verdoorn effect, discussed in chapter I; second, the Marx-Webb effect which was
 2850 the subject of chapter II together with Verdoorn's law again; and finally the existence
 2851 of demand regimes discussed in the present chapter.

2852

Part IV

2853

Conclusion

Conclusion

The Main Findings Of The Present Thesis

The fall of world-wide average GDP growth rates since the Global Financial Crisis 2007 is only the latest decrease in a steady fall of GDP growth rates everywhere since the 1980s. This development nourished the fears of secular stagnation amongst mainstream economists. While the possible reasons for secular stagnation are energetically discussed, we tried to show in the present thesis that there exists a much more straightforward explanation for sustained low growth rates than imperfect capital markets, demographic change or less innovative innovations. Rather, the explanation that we put forward finds the source of growth rates in two economic mechanisms linking real wage growth to productivity growth.

One such mechanism is Verdoorn's law, the effect of output/demand growth on productivity growth. This mechanism is typically assumed to be positive and smaller than 1, indicating increasing returns to scale. Most of the literature on Verdoorn's law finds values between 0.30 and 0.60. Using a newly constructed data set, in chapter I we use meta-regression analysis to analyse the available literature on Verdoorn's law for signs of publication bias, i.e. systemic distortions of the reported effects due to unpublished estimates, selection bias and (possibly) counter-intuitive results. To

our knowledge, this is the first meta-regression analysis conducted on Verdoorn's law. we do find that the literature on Verdoorn's law as a whole offers no indications for publication bias. In addition, we construct meta-averages (also known as 'true values' in the meta-regression literature) which pool all the available estimates in the literature on Verdoorn's law. Our study finds meta-averages of the Verdoorn effect between 0.44 and 0.69, depending on the specification and control variables chosen to estimate Verdoorn's law. Hence, compared to the articles trying to summarise the available literature we find that on average, the Verdoorn effect is higher than commonly assumed.

In order to explain low productivity growth via Verdoorn's law, we need a further economic mechanism explaining GDP growth via real wage growth. The Bhaduri-Marglin model or profit-led/wage-led model provides such a mechanism, explaining GDP growth via the functional distribution of income. In our example, we use the change in the wage share, which by definition is the result of real wage growth and productivity growth. Our contribution to the available literature consists in a second meta-regression analysis conducted in chapter III, this time using the available empirical literature on the Bhaduri-Marglin model. The Bhaduri-Marglin model is used to estimate a country's demand regime. Typically, neo-Goodwinians find profit-led demand regimes while neo-Kaleckians tend to find wage-led demand regimes. Our meta-regression analysis tests for common estimation controls as well as paper-specific characteristics and find a meta-average of -0.6 . This result indicates that the average country is found to be profit-led – even though the world as a whole is probably wage-led (Lavoie and Stockhammer 2013a).

The second mechanism we use to explain low productivity growth is the Marx-Webb effect. Here, higher real wages lead to higher investments in labour-saving

2897 technology, thereby increasing productivity. Furthermore, higher real wages increase
2898 motivation, which again increases productivity. While the first argument is more
2899 commonly used in heterodox economics, the second argument has been proposed by
2900 mainstream economics as well, especially in the available literature on efficiency wages.
2901 In chapter II, we estimate the Marx-Webb effect together with the Verdoorn effect. we
2902 use a panel data set of 23 EU member countries between 1997 and 2017 on different
2903 sectoral levels called 'EU-KLEMS' (Stehrer et al. 2019). Using EU-KLEMS, we estimate
2904 both Verdoorn's law and the Marx-Webb effect. In order to distinguish between Okun's
2905 law and Verdoorn's law, we use an ARDL model which differentiates between short-
2906 run effects and long-run effects. Furthermore, we use a special ARDL version which
2907 is robust to cross-sectional dependence (called CS-ARDL). The estimation's results
2908 indicate Verdoorn effects between 0.36 and 0.97 and Marx-Webb effects ranging from
2909 0.19 to 0.31.

2910 Apart from the results presented in the chapters of this thesis themselves, there
2911 are a few other thoughts that deserve mentioning. The first concerns the narrative of
2912 secular stagnation and the counter-narrative of stagnating aggregate demand proposed
2913 (amongst many others) by Storm and Naastepad (2013), Storm (2017), and Hein and
2914 Tarassow (2010) and myself. Over the past years we have been thinking about heterodox
2915 models of demand-, productivity- and employment regimes as models completely
2916 separated from the mainstream argument of secular stagnation. To our surprise, both
2917 the proposed counter-narrative as well as the secular stagnation-narrative have common
2918 roots in a series of debates in the 1950s between Paul Sweezy and Joseph Schumpeter
2919 about the future of capitalism (Roubtsova 2016; Lavoie 2017a). Although in both cases
2920 the origins might be traced back even further, both narratives did evolve side-by-side,
2921 even if there was not much interaction between the two so far.

2922 Moreover, the results of our thesis indicate a complicated position for adherents of
 2923 wage-led demand-, productivity- and employment-growth policies, mainly due to the
 2924 meta-average in chapter III which finds a profit-led demand regime.

2925 **The Distribution-Productivity-Employment-Nexus Put Into Prac-** 2926 **tice**

2927 The corresponding value of -0.6 , together with the other results in this thesis, renders
 2928 wage-led growth in all three dimensions improbable. Let us go through an example.
 2929 The model proposed in the introduction can be reduced to the following model.

$$\dot{\psi} = \dot{w} - \dot{y} \quad (3.9)$$

$$\dot{y} = \dot{y}_w \dot{w} + \dot{y}_q \dot{q} \quad (3.10)$$

$$\dot{q} = \epsilon \psi \quad (3.11)$$

2930 The change in the wage share $\dot{w}\psi$ is a product of real wage growth \dot{w} and produc-
 2931 tivity growth \dot{y} . Demand growth \dot{q} is a results of the change in the wage share and
 2932 the demand regime ϵ . Productivity growth itself is the result of the demand-induced
 2933 Verdoorn effect \dot{y}_q and the real-wage-induced Marx-Webb effect \dot{y}_w .

2934 Expressed in real wage growth, we get the following equations for productivity
 2935 growth and demand growth.

$$\dot{y} = \frac{\dot{y}_w \dot{w} + \epsilon \dot{y}_q \dot{w}}{1 + \dot{y}_q \epsilon} \quad (3.12)$$

$$\dot{q} = \epsilon \dot{w} \left(1 - \frac{\dot{y}_w + \dot{y}_q \epsilon}{1 + \dot{y}_q \epsilon}\right) \quad (3.13)$$

2936 We can use the results conducted in the thesis on hand for the variables in this
 2937 model. Let us start with values taken only from meta-regression analyses (Variant I
 2938 in table 3.5a. Chapters I and III provide us values for \dot{y}_q (0.44 – 0.69) and ϵ (–0.6).
 2939 We did not conduct a meta-regression on the Marx-Webb effect in the present thesis,
 2940 however the meta-regression analysis on efficiency wages by Krassoi Peach and Stanley
 2941 (2009) could be used as a proxy. The resulting meta-averages in Krassoi Peach and
 2942 Stanley (2009) range between 0.28 and 0.30, while our own estimates of the Marx-
 2943 Webb coefficient conducted in chapter II lie within 0.19 and 0.31. For the sake of
 2944 the argument, let us assume a Marx-Webb coefficient of $\dot{y}_w = 0.30$ and a Verdoorn
 2945 coefficient of $\dot{y}_q = 0.69$. Given a profit-led demand regime ($\epsilon = -0.6$), the implications
 2946 for a 1%-increase in real wages are as follows. The increase in the wage share has two
 2947 effects on productivity growth, which in combination with real wage growth affects the
 2948 change in the wage share itself (+1.19%). The increase in the wage share then affects
 2949 demand growth via the demand regime, which in the meta-regression from chapter III
 2950 was found to be –0.6. As a result of an increase in the wage share under a profit-led
 2951 demand regime, demand growth changes by –0.72%, which via Verdoorn’s law creates
 2952 a Verdoorn effect of –0.49. Also, the direct effect of real wage growth on productivity
 2953 growth via the Marx-Webb effect changes productivity by +0.30% (the result of the
 2954 meta-regression on efficiency wages). Total productivity therefore changes by –0.19%,

2955 the sum of Verdoorn's law and the Marx-Webb effect. As was already explained, the
2956 growth in productivity has a feedback effect on the wage share, decreasing the overall
2957 effect of the original increase in real wages. Finally, we can calculate employment
2958 growth as the residual of demand growth and productivity growth. This leaves us
2959 a change of employment of -0.52 . In the average, profit-led economy given by the
2960 results of three meta-regression analyses, the consequences of an increase in real wages
2961 are grim on all fronts. The combination of a strongly profit-led economy and a high
2962 Verdoorn coefficient results in a scenario in which the Verdoorn effects dominate the
2963 Marx-Webb effects on productivity growth. As a result, the fall in employment growth
2964 is somewhat cushioned by the simultaneous decrease in productivity growth. Hence,
2965 demand, productivity and employment all experience a decline, even though workers
2966 manage to increase their share of national income due to the slowdown in productivity
2967 growth.

2968 Table 3.5a repeats the exercise with all extreme ranges available from the results of
2969 chapters I, II, III and Krassoi Peach and Stanley (2009). The logic of Variant I repeats
2970 itself in all the other variants, although with small differences. While most variants
2971 experience a decrease in demand growth, productivity growth and employment growth
2972 together with an increase in the wage share, there is one exception. In Variant II, the
2973 positive Marx-Webb effect dominates the negative Verdoorn effect so that productivity
2974 growth becomes positive.

2975 The reason of this negative effect of real wages on all three regime once again
2976 lies in the combination of a strongly profit-led demand regime and a high Verdoorn
2977 coefficient. Let us remember that the meta-average for the demand regime in chapter
2978 III does only report the demand regime of the average country. An average country,
2979 however, does not exist. At the same time, due to the very uneven distribution of

2980 demand regime studies across all countries, the introduction of country dummies into
2981 our meta-regression was something that we decided not to do. If either the profit-led
2982 nature or the Verdoorn effect were weaker, there would be hope for the Marx-Webb
2983 effect to dominate Verdoorn's law and for the productivity regime to be wage-led.
2984 Even in this case, employment would still be profit-led. Only in the case of a wage-led
2985 demand regime, or (although in a much less favourable way) under a more profit-led
2986 productivity regime than the demand regime, would an increase in real wages lead to
2987 an increase in employment.

2988 **Contributions Of The Present Thesis**

2989 A first contribution of this thesis lies in using meta-regression analysis as a quantitative
2990 reading of economic literature. More precisely we use meta-regression analysis to
2991 provide a detailed summary of the empirical literature on Verdoorn's law (in chapter
2992 I) and the Bhadhuri-Marglin model, also known as the wage-led/profit-led model (in
2993 chapter III. Common journal articles are not able to provide a comprehensive overview
2994 of all empirical results in a specific field of research. In comparison, commonly used
2995 MRA tools such as funnel plots (Figures 1.4, 3.5 and 3.4) are able to depict the primary
2996 literature in one simple graph. Using such method, our thesis also raises awareness
2997 for the issue of trust in intransparent research processes. At the present point in time,
2998 many econometric studies are not reproducible. Either the underlying data sets or the
2999 code used in statistical software are often not published by authors, facts that tend to
3000 impair the reliability of these studies.

3001 Furthermore, there exists strong peer pressure among the economist community
3002 to obtain statistically significant results, indicating a very skewed understanding of

	Variant I: all effects taken from MRAs (max)	Variant II: all effects taken from MRAs (min)
Marx-Webb coefficient (gamma)	0,30	0,28
Verdoorn coefficient (delta)	0,69	0,44
Demand regime (epsilon)	-0,60	-0,60
Real wage growth (in %)	1,00	1,00
Change in wage share (%)	1,19	0,98
Demand growth (%)	-0,72	-0,59
Verdoorn effect (%)	-0,49	-0,26
Marx-Webb effect (%)	0,30	0,28
Productivity growth (%)	-0,19	0,02
Employment growth (%)	-0,52	-0,61
	Variant III:Marx-Webb effect from chapter II (max)	Variant IV:Marx-Webb effect from chapter II (min)
Marx-Webb coefficient (gamma)	0,31	0,19
Verdoorn coefficient (delta)	0,69	0,44
Demand regime (epsilon)	-0,60	-0,60
Real wage growth (in %)	1,00	1,00
Change in wage share (%)	1,18	1,10
Demand growth (%)	-0,71	-0,66
Verdoorn effect (%)	-0,49	-0,29
Marx-Webb effect (%)	0,31	0,19
Productivity growth (%)	-0,18	-0,10
Employment growth (%)	-0,53	-0,56
	Variant V: Both effects from chapter II (max)	Variant VI:Both effects from chapter II (min)
Marx-Webb coefficient (gamma)	0,31	0,19
Verdoorn coefficient (delta)	0,97	0,36
Demand regime (epsilon)	-0,60	-0,60
Real wage growth (in %)	1,00	1,00
Change in wage share (%)	1,64	1,03
Demand growth (%)	-0,98	-0,62
Verdoorn effect (%)	-0,95	-0,22
Marx-Webb effect (%)	0,31	0,19
Productivity growth (%)	-0,64	-0,03
Employment growth (%)	-0,34	-0,59

Table 3.4 – Effects of a 1 %-pt.-increase in real wages on demand growth, productivity growth and employment growth.

(a) Additionally to the results from Chapters I to III, Variants I and II use results from a meta-regression analysis of efficiency wages as a proxy for the Marx-Webb effect (Krassoi Peach and Stanley 2009).

3003 scientific progress. The road is paved with failure to prove existing theories just as much
3004 – if not more so – than success. As was already shown much earlier than in the works of
3005 Karl Popper, verification, even if repeated a thousand times cannot prove the correctness
3006 of a theory. As a result, this common misconception of scientific progress manifests
3007 itself in economic journals not accepting econometric studies without statistically
3008 significant results. The consequence is a hidden pile of unpublished studies which are
3009 not equipped with less statistical power than their published (and more prestigious)
3010 cousins. Furthermore, the pressure to submit studies with statistically significant results
3011 inflate the reported estimates. Both effects yield to significant overestimation of effects
3012 in entire fields of research. This problem is well-known to researchers in meta-analysis.
3013 As a consequence the 'Paldam Principle' states that in general, one is advised to divide
3014 all reported estimates by 2 no matter the economic journal – be it the *American Economic*
3015 *Review* or the *Journal of Ibn Haldun Studies*.

3016 The issue only becomes more important in economics, as political and economic
3017 interests do influence studies and often even create entire think tanks for their own
3018 agenda. Meta-regression analysis is spreading quite rapidly in economics, but it still is
3019 unknown to most economists. The MRAs in this thesis estimate potential publication
3020 bias. If publication bias is found, as is the case in chapter III, we use meta-regression
3021 analysis to give unpublished studies the space in science it should have, while reducing
3022 the impact of studies that do not merit it. In the MRA in chapter I, we could not find
3023 signs for publication bias in the literature on Verdoorn's law. This is a rare occurrence,
3024 as the vast majority of conducted meta-regression analysis does find signs of publication
3025 bias. In the case of the MRA on the wage-led/profit-led model in chapter III, we do
3026 find signs of publication bias in favour of a wage-led demand regime. This implies that
3027 there are a number of unpublished studies that find aggregate demand (domestic as

3028 well as total) to be profit-led.

3029 With roughly five years of use of meta-analytic tools, we came up with certain ideas
3030 on how to reduce the impact of these structural problems. First, the importance of
3031 academic studies should not be valued based on pseudo-neutral metrics such as impact
3032 factors or the statistical significance of the presented results. Rather, published empirical
3033 studies should be ranked based on how many replication studies did not manage to find
3034 different results. In the same vein, all empirical studies should have to go through a
3035 process similar to pre-registered controlled trials in medicine. All studies would have to
3036 me registered before the start, with a clear outline of the research to be undertaken and
3037 the methods used. All data sets would need to be published, including the code for the
3038 statistical software used together with the published study. These measures would help
3039 to reduce the amount of studies 'ending up in the drawer' and never seeing the light of
3040 day. Another suggestion lies in an intra-journal agreement on basic statistical data that
3041 need to be reported for any econometric results. No meta-regression analyst should
3042 have to obtain the number of observations or standard errors/t-statistics by e-mail in
3043 2021 instead of a direct look at an output table (even less so if he is trying to finish his
3044 PhD).

3045 A third contribution to the available literature lies in the estimation of Verdoorn's
3046 law in chapter I and of demand regimes in chapter III, after controlling for publication
3047 bias and study-specific moderator variables. The resulting meta-averages have higher
3048 statistical power than the individual estimates in the primary literature and yield more
3049 precise results (if an underlying effect actually exists). Both chapters find statistically
3050 significant meta-averages for Verdoorn's law and a profit-led demand regime, indicating
3051 that in both cases the effect of interest does indeed exist. Furthermore, the MRAs
3052 conducted in this thesis allow the reader to comprehend the differences in primary

3053 literature estimates in a more detailed way, taking into account differences in estimation
3054 methods, control variables used, the specification chosen or the year of publication.
3055 Here, the contribution consists in lifting the fog to a certain extend. It is not just about
3056 *Kaldor vs. Rowthorn* or *neo-Kaleckians vs. neo-Goodwinians* anymore. With our two
3057 MRAs, we do hope to provide a foundation which both (admittedly stylised) opposed
3058 sides can use discern difference in economic theory from difference in data or methods
3059 used.

3060 The fourth contribution lies in a facilitated way to review the existing literature.
3061 Apart from providing concrete numbers on key economic indicators, the point of meta-
3062 regression analysis is to summarise the key points in a certain field, including historical
3063 origins, potential dividing lines, seminal contributions to the existing literature, exten-
3064 sions and open questions. We do hope that with our present thesis, we did manage
3065 to reduce the overall time needed for the interested reader to get an overview of the
3066 respective literature by a considerable margin.

3067 Finally, the literature on the Marx-Webb effect is rather small (if one does not
3068 equate the literature on efficiency wages with the Marx-Webb effect, that is). The
3069 most-often cited papers are Lima (2004), Marquetti (2004), Naastepad (2006), Vergeer
3070 and Kleinknecht (2007), Hein and Tarassow (2010), and Storm and Naastepad (2013).
3071 Hence the panel data estimation of both Verdoorn's law and the Marx-Webb effect in
3072 chapter increases the amount of studies on the topic by another one II constitutes the
3073 fifth contribution of this thesis. Most studies on Verdoorn's law and/or the Marx/Webb
3074 effect do not take into account potential cross-sectional dependence. Furthermore,
3075 most studies do not differentiate between the short run and the long run. Chapter II
3076 in this thesis contributes to the available literature in that it takes into account both
3077 issues, thereby reducing the risk of potentially biased results. Still, more studies on the

3078 Marx-Webb effect have to be conducted. Maybe at some point in time, this chapter will
3079 form part on yet another meta-regression analysis on the Marx-Webb effect one day
3080 (after all, following Stanley, Doucouliagos, et al. (2013), the minimal amount of studies
3081 needed for a MRA is 2). Until such a study is published, the MRA on efficiency wages
3082 by Krasso Peach and Stanley (2009) can be used as a proxy for the Marx-Webb effect.

3083 **Policy Implications Of This Thesis**

3084 As a consequence of including the productivity regime and employment regime in post-
3085 Keynesian analysis, even under a wage-led demand regime, an increase in employment
3086 is not evident at all. Indeed, the political implications are worrying from a trade union
3087 perspective. Fighting for higher wages for their members, trade unions might win
3088 in the short run. In the long run, however, they will erode their own membership
3089 base as fewer trade union members will find themselves to be employed. With falling
3090 employment, trade unions lose bargaining power and Capitalism as of itself might not
3091 create the necessary jobs. In such a case, a project of state-led employment projects
3092 might be the only way forward, for example in the form of public jobs or via decreases
3093 in weekly working time.

3094 The case of working time reduction is of particular interest, as contrary to past
3095 trends of slow but steady global decreases in average working time, several countries
3096 have again extended the average weekly working time since the early 2000s. Examples
3097 for this are Germany or France under the current Macron government. In Austria, a
3098 new law increased the maximum allowed working time per week from 50 to 60 hours.
3099 However, these extensions are quite in opposition to the long-term trend of decreasing
3100 working time during the past 150 years. As Figure 3.8 shows, average weekly working

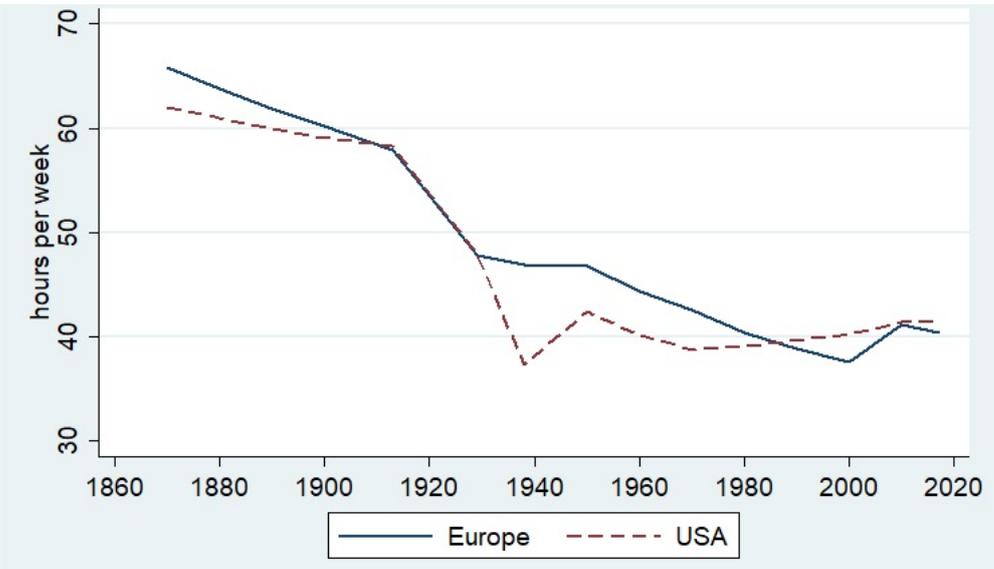


Figure 3.8 – Evolution of Weekly Working Time over 147 Years (full-time equivalents); sources: 1870-2000 – Huberman and Minns (2007) ; 2000-2017 – stats.oecd.org

3101 decreased after the second world war both in Europe and in the United States. This
3102 process of decreasing working time was possible due to steady increases in productivity
3103 and usually accompanied by an increase in wages. This increase in wages happened
3104 in order to account for lost compensation due to less labour time. Working time
3105 reduction, accompanied by full wage compensation was the classic demand of trade
3106 unions during the ‘golden age of capitalism’. This continuous reduction slowed down
3107 once the 40-hours-week was achieved. Nevertheless, there are economic circumstances
3108 that can facilitate the introduction of reforms concerning working time reduction.
3109 For instance, productivity increases determine long-term economic growth and create
3110 future possibilities for redistributive measures in a capitalist economy. As we can
3111 see in Figure 3.9, there is a clear negative relation between working hours and (labour)
3112 productivity in OECD countries in 2017. This relation holds for all the previous years
3113 covered by the OECD statistical database.

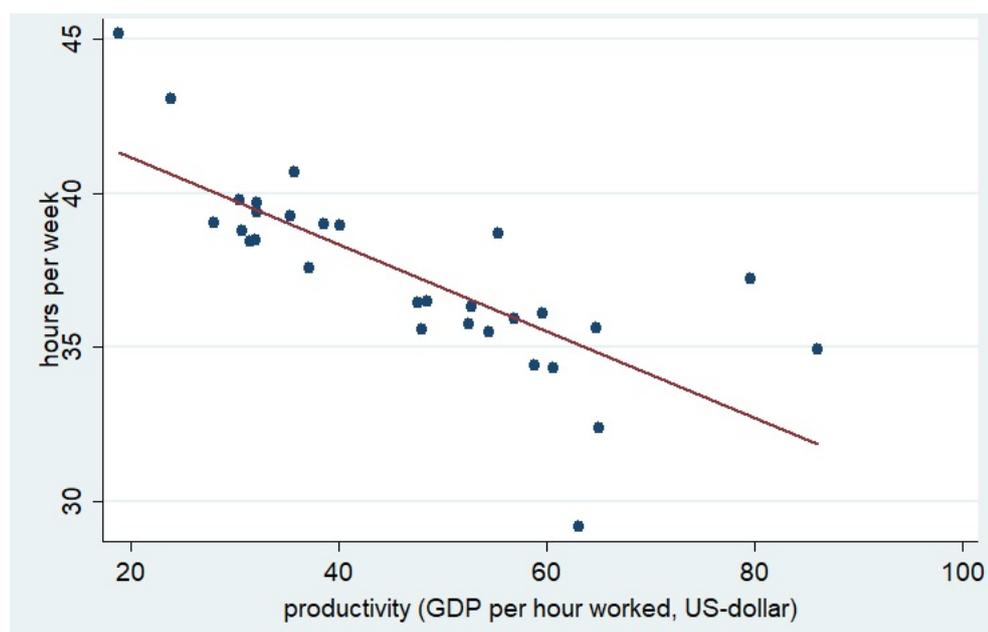


Figure 3.9 – Working Time and Productivity in OECD Countries (2017) in constant prices, 2010 PPPs; source: stats.oecd.org

3114 One reason for this negative relation is that working hours have harmful effects on
 3115 worker's well-being. Longer working hours are associated with a deterioration of both
 3116 physiological and psychological health (Sparks et al. 1997). Another way of thinking
 3117 about the relation between average weekly working hours and productivity is that
 3118 increases in productivity enable decreases in working time. More productive countries
 3119 can, therefore, afford reductions in working time with less difficulties. It is important
 3120 to keep in mind that the effects regarding changes in working hours vary considerably
 3121 depending on the time span of this change. A reduction in the retirement age has to
 3122 be interpreted as a decrease in life-long working time, while the introduction of paid
 3123 holiday weeks represents reductions in yearly working time. A decrease in weekly
 3124 working hours might change employment structures, with workers switching from
 3125 part-time to full-time positions. This would have especially strong implications for

3126 women, who in most countries represent a much larger share of part-time workers than
3127 men. The demands regarding the redistribution of working time and real wages of the
3128 international workers movement cannot be properly understood in isolation. Indeed,
3129 they have always been linked to the demands of the international women's rights
3130 movement for a reduction of working hours and the redistribution reproductive/care
3131 work, both inside and outside of the working place.

3132 Following this logic, it is vitally important that the decrease in working time does
3133 not constitute one singular event. As was already discussed above, employment might
3134 have a tendency to decrease over time. This implies that working time needs to decrease
3135 steadily to guarantee the fragile balance between demand growth, productivity growth
3136 and employment growth. Following the argument of the 'political business cycle'
3137 presented in Kalecki (1943), capitalism in itself might not be able to politically sustain
3138 longer periods of full employment. If capitalism as a system of economic and political
3139 organisation manages to abolish unemployment and rising inequality in a sustainable
3140 way, then a virtuous cycle of rising wages, productivity and full employment is possible.
3141 If capitalism is not able to do so – and the short history of humankind is not supportive
3142 in that regard – then capitalism as a whole will have to be replaced by another system
3143 that is.

3144 **Future Areas Of Research**

3145 Apart from adjusting shortcomings of the present work, this thesis leaves me with
3146 many potential research projects. The following list is a small part of the many ideas
3147 occurring over the past six years. As such, the following paragraphs only enumerate
3148 some recurring themes that came up time and again.

3149 One obvious area of research consists in the use of meta-regression analysis for
3150 other fields of debate among economists in general. The advantage of conducting
3151 meta-regression studies is that one necessarily becomes familiar with entire fields of
3152 literature and econometric methods. Indeed, the key interest of meta-regression analysis
3153 is to explain differences in estimation results in the primary literature in its entirety.
3154 Furthermore, the resulting meta-regression analysis has the enormous advantage of
3155 enabling the reader to comprehend most of the debate concerning the respective topic
3156 by reading one single study instead of dozens or hundreds of studies.

3157 Another interesting potential area of research lies in the combination of meta-
3158 regression analysis with bibliometrics. Bibliometrics, the use of statistical instruments
3159 to analyse articles, texts and other documents can provide many valuable insights.
3160 For example, Fix (2020) uses a word-counting bot to analyse the language used in 43
3161 economics textbooks (called *econospeak* by the author). He then compares each word
3162 relative to the number of its uses in the 43 textbooks as well as the general use of the
3163 word via Google corpus. As a result Fix (2020) separates *econospeak* into four groups:
3164 the quirks, the jargon, the underused words and the neglected words. One could use
3165 one's imagination to do a similar exercise for the top 10 journals by economic schools
3166 of thought - for example for the past 10 years. Similarly one could track certain words
3167 and their change between groups over time (for example from niche to quirk and back).
3168 Since inequality was not a big topic in the economic mainstream before the global
3169 financial crisis and the publication of Piketty (2014), one could imagine that the word
3170 'inequality' might have changed from the neglected group to the jargon.

3171 Combining the literature research part of a particular meta-regression analysis with
3172 corresponding citation analysis represents another promising area of research. The
3173 use of citation networks could help to identify many more suitable primary studies

3174 than one would possibly find by only using key words. Furthermore, citation analysis
3175 might be used as a suitable metric to represent certain isolated groups of citations, for
3176 example because of different schools of thought. In continuation, several moderator
3177 variables for the core studies of these different citation clusters could then be used as
3178 proxies for different economic schools of thought, something that was can be difficult
3179 to code in meta-regression analysis so far.

3180 Typical meta-regression analyses are very work-intensive and time-consuming
3181 and need to be carried out with great care as they tend to imply a high propensity of
3182 data-error. Leif (2016) present a tool called 'p-curve' which examines the distribution
3183 of p-values in any given amount of studies. The idea behind this analysis is that there
3184 exist certain threshold values for p-values, which have to be reached in order to be
3185 eligible for publication. Researchers will therefore modify their estimation specification
3186 until they find statistically significant results (p-hacking). An unusual distribution of
3187 p-values around certain thresholds (for example 0.05) might indicate that some studies
3188 might be subject to p-hacking. The advantage of the p-curve is that it is easy to use and,
3189 as the only metric of interest are p-values, the studies in question need not to share a
3190 common topic. One could use the p-curve to analyse for example all studies published
3191 in 1988, in journal X or of author or institution Y, all studies with the word 'Z' in title
3192 etc.

3193 As was briefly discussed before, it is our belief that the resulting pressures on
3194 employment growth described in section IV can only be overcome either by public
3195 job programs or through a reduction in weekly working time in the long run. While
3196 the effect of working hours reduction on health and productivity is well-documented
3197 (Sparks et al. 1997), the literature on the relation between working time reduction
3198 and employment however does not agree on the overall effect (Poyntner 2016). Here,

3199 meta-regression analysis could be used to explain the differences among respective
3200 econometric studies, their methods and their results. For example, do all of them
3201 actually estimate the effect of a change in weekly working time? Or do some take into
3202 account lifetime working time reduction, most often in form of earlier retirement age.
3203 Similarly, an MRA on the effects of a reduction of working time on productivity and/or
3204 unit labour costs could be a crucial stepping stone to provide value-added into the
3205 existing debate.

3206 With regards to the effects of a change in real wages on productivity, the idea of
3207 'conflict inflation', that is the post-Keynesian idea of distributional struggle driving
3208 inflation deserves a re-evaluation. Following Rowthorn (1980), an increase in wages will
3209 lead to a distributional struggle between capitalists raising prices to pass on the increase
3210 in cost of production and workers demanding higher wages to keep the desired level of
3211 real wages. If the increase in wages, both via Verdoorn's law and the Marx-Webb effect,
3212 really leads to higher productivity, then productive capacity increases. But if productive
3213 capacity increases, then inflationary pressures should weaken in the long run. Ignoring
3214 the possibility that this research has possibly already been conducted in Storm and
3215 Naastepad (2012), a study using a co-integration approach with an error-correction
3216 model could try to distinguish between a short-run effect and a long-run of wage growth
3217 on inflation. Following the logic of the argument, the short-run effect of a growth in
3218 wages should have a positive effect on inflation while the long-run effect should be
3219 weaker, or even negative. This estimation would use firm-level data variables together
3220 with variables which act as proxies for political power, such as the employment ratio
3221 or trade union coverage. The main result ultimately depends on whether profits get
3222 reinvested or distributed amongst share-holders. The value-added here lies in the fact
3223 that similar ideas have been portrayed by the French Regulationist school. However,

3224 we do know of no empirical study within this economic paradigm yet. The proposed
3225 project would therefore lead to a deeper integration between the two schools of thought
3226 regarding conflict inflation and the productivity regime.

3227 Working on the meta-regression of the Bhadhuri-Marglin we got curious whether
3228 the demand regime would change depending on the kind of public social infrastructure
3229 in the respective country. While in Stockhammer, Durand, and List (2016), we distin-
3230 guish in a limited way between different social welfare regimes and discuss differing
3231 growth models, no such thing has been done in the context of the Bhaduri-Marglin
3232 model so far. Using Esping-Andersen (1990) as a starting point for the literature research,
3233 the idea is to group countries according to the welfare state regimes they are com-
3234 monly attributed to. According to Esping-Andersen (1990), welfare states vary in their
3235 dimensions of de-commodification and stratification, resulting in three stereotypical
3236 welfare regimes - the liberal regime, the conservative regime and the social-democratic
3237 regime. The question then arises whether certain welfare regimes correspond to specific
3238 demand, productivity or employment regimes. Implicitly, this research question touches
3239 the issue of policy agency regarding changes between regimes and could provide a new
3240 dimension of research to the existing literature.

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3647

Appendix

A

3648

Primary Literature Used In MRA On

3649

Verdoorn's Law (Chapter I)

Primary Literature Used in MRA on Verdoorn's Law

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3774 Appendix **B**

Alternative Specifications For Verdoorn's Law (Chapter II)

Table B.1 – Verdoorn's Law in Total Manufacturing (Kaldor specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
value added growth	0.343** (0.140)	0.031 (0.102)	0.024 (0.127)	0.097 (0.098)
real wage growth	-0.057 (0.067)	-0.160+ (0.045)		
productivity difference growth	0.105 (0.065)	0.103 (0.088)	0.151** (0.075)	0.155 (0.099)
L.employment growth	0.213* (0.113)	0.307** (0.117)	-0.018 (0.101)	-0.058 (0.152)
D.Manufacturing share of value added	-0.012 (0.011)		0.006 (0.011)	
Manufacturing share of value added		0.023** (0.010)		0.012 (0.009)
lr_VA_share_manuf		0.031 (0.039)		-0.102 (0.101)
lr_cons		-0.608 (0.952)		4.156 (4.778)
lr_g_EMP		-0.693+ (0.117)		-1.058+ (0.152)
lr_g_GAP		0.045 (0.094)		0.094 (0.073)
lr_g_VA_Q		0.125 (0.276)		0.548 (0.484)
lr_g_real_wages		-0.357** (0.152)		
wage share by industry			-0.297** (0.142)	0.062 (0.161)
lr_wshare_by_industry				-2.491 (2.143)
Constant	0.027 (0.116)	-0.124 (0.142)	0.102 (0.773)	-0.090 (0.688)
Observations	437	437	437	437
R2	0.18	0.19	0.19	0.20

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.2 – Verdoorn's Law in Total Manufacturing (Kaldor specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
productivity difference (log)	0.099 (0.211)	0.327 (0.197)	0.114 (0.209)	0.267 (0.239)
LD2.persons employed (1000, log)	-0.003 (0.122)		0.013 (0.101)	
L.persons employed (1000, log)		0.450+ (0.080)		0.368*** (0.110)
D.value added (log)	0.281 (0.197)		0.109 (0.210)	
value added (log)		0.551+ (0.118)		0.542+ (0.128)
D.real wages (log)	-0.256*** (0.094)			
real wages (log)		-0.092 (0.071)		
D.Manufacturing share of value added	-0.022 (0.018)		-0.022 (0.022)	
Manufacturing share of value added		-0.010 (0.009)		-0.006 (0.007)
lr_VA_share_manuf		-0.120 (0.101)		0.153 (0.183)
lr__cons		-89.111 (73.630)		-4.244 (4.398)
lr_ln_EMP		-0.550+ (0.080)		-0.632+ (0.110)
lr_ln_GAP		25.690 (25.888)		1.021 (0.848)
lr_ln_VA_Q		11.055 (10.363)		1.033+ (0.217)
lr_ln_real_wages		-2.435 (3.582)		
D.wage share by industry			-0.090 (0.182)	
wage share by industry				0.239* (0.127)
lr_wshare_by_industry				-0.307 (0.961)
Constant	3.160 (3.273)	1.825 (1.215)	1.779 (2.071)	0.764 (1.062)
Observations	324	360	324	360
R2	0.13	0.06	0.19	0.06

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.3 – Verdoorn's Law in Manufacturing Sub-sectors (Kaldor specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
value added growth	0.268+ (0.028)	0.278+ (0.026)	0.204+ (0.032)	0.237+ (0.049)
real wage growth	-0.236+ (0.024)	-0.244+ (0.023)		
productivity difference growth	0.112+ (0.022)	0.116+ (0.021)	0.114+ (0.023)	0.130+ (0.024)
L.employment growth	-0.001 (0.027)	0.007 (0.027)	-0.074** (0.031)	-0.116+ (0.034)
D.Manufacturing share of value added	0.009* (0.005)		0.003 (0.005)	
Manufacturing share of value added		0.004 (0.003)		0.005 (0.004)
lr_VA_share_manuf		0.032* (0.017)		0.004 (0.015)
lr_cons		-1.211* (0.734)		-4.555 (3.701)
lr_g_EMP		-0.993+ (0.027)		-1.116+ (0.034)
lr_g_GAP		0.021 (0.075)		-0.049 (0.127)
lr_g_VA_Q		0.284+ (0.077)		-0.253 (0.288)
lr_g_real_wages		-0.269+ (0.075)		
wage share by industry			0.041 (0.056)	0.101 (0.065)
lr_wshare_by_industry				-0.245 (0.248)
Constant	-0.082 (0.177)	0.039 (0.259)	-0.409 (0.530)	-1.321 (0.831)
Observations	5757	5757	5757	5757
R2	0.21	0.21	0.27	0.25

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.4 – Verdoorn's Law in Manufacturing Sub-sectors (Kaldor specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
value added (log)	0.180*** (0.055)	0.346+ (0.031)	0.101 (0.066)	0.305+ (0.033)
real wages (log)	-0.181+ (0.052)	-0.247+ (0.026)		
productivity difference (log)	0.201*** (0.067)	0.166+ (0.030)	0.161* (0.086)	0.180+ (0.037)
LD2.persons employed (1000, log)	-0.054* (0.031)		-0.062* (0.032)	
L.persons employed (1000, log)		0.246+ (0.031)		0.260+ (0.036)
D.Manufacturing share of value added	0.011 (0.008)		0.014 (0.010)	
Manufacturing share of value added		0.004 (0.005)		0.008* (0.005)
lr_VA_share_manuf		-0.133 (0.085)		-0.022 (0.045)
lr_cons		-9.480 (7.575)		1.785 (2.064)
lr_ln_EMP		-0.754+ (0.031)		-0.740+ (0.036)
lr_ln_GAP		-0.109 (0.368)		0.438** (0.223)
lr_ln_VA_Q		0.121 (0.531)		0.661** (0.298)
lr_ln_real_wages		0.079 (0.368)		
wage share by industry			0.059 (0.108)	0.246+ (0.057)
lr_wshare_by_industry				0.562+ (0.170)
Constant	0.731 (0.818)	-0.065 (0.469)	1.610** (0.810)	-0.114 (0.518)
Observations	3636	4040	3636	4040
R2	0.20	0.10	0.22	0.12

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.5 – Verdoorn's Law in All Main Sectors (Kaldor specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
value added growth	0.391+ (0.029)	0.397+ (0.028)	0.305+ (0.034)	0.293+ (0.032)
real wage growth	-0.239+ (0.024)	-0.239+ (0.025)		
productivity difference growth	0.139+ (0.031)	0.163+ (0.031)	0.168+ (0.030)	0.168+ (0.031)
L.employment growth	0.092+ (0.026)	0.057** (0.028)	-0.006 (0.026)	-0.075*** (0.027)
D.Manufacturing share of value added	0.004 (0.003)		0.009* (0.005)	
Manufacturing share of value added		0.004 (0.003)		0.002 (0.003)
lr_VA_share_manuf		0.008 (0.007)		-0.004 (0.006)
lr_cons		-0.087 (0.225)		0.836 (0.683)
lr_g_EMP		-0.943+ (0.028)		-1.075+ (0.027)
lr_g_GAP		0.023 (0.103)		0.034 (0.116)
lr_g_VA_Q		0.123 (0.219)		0.083 (0.117)
lr_g_real_wages		-0.118 (0.167)		
wage share by industry			0.044 (0.098)	0.336** (0.156)
lr_wshare_by_industry				0.302* (0.163)
Constant	-0.109** (0.052)	-0.154** (0.067)	0.144 (0.161)	-0.028 (0.163)
Observations	7106	7106	7106	7106
R2	0.14	0.13	0.17	0.19

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.6 – Verdoorn's Law in All Main Sectors (Kaldor specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wages (log)	-0.137+ (0.041)	-0.247+ (0.025)		
productivity difference (log)	0.118** (0.056)	0.203+ (0.048)	0.204+ (0.055)	0.299+ (0.045)
LD.persons employed (1000, log)	-0.262+ (0.037)		-0.311+ (0.037)	
L.persons employed (1000, log)		0.174+ (0.030)		0.146+ (0.029)
D.value added (log)	0.216+ (0.038)		0.190+ (0.042)	
value added (log)		0.431+ (0.032)		0.445+ (0.038)
D.Manufacturing share of value added	-0.001 (0.006)		0.002 (0.005)	
Manufacturing share of value added		-0.007 (0.004)		-0.006 (0.004)
lr_VA_share_manuf		-0.056 (0.056)		-0.005 (0.008)
lr_cons		-3.378 (2.382)		2.878 (3.891)
lr_ln_EMP		-0.826+ (0.030)		-0.854+ (0.029)
lr_ln_GAP		0.731 (0.513)		0.088 (0.298)
lr_ln_VA_Q		0.638+ (0.084)		0.080 (0.404)
lr_ln_real_wages		-0.599*** (0.230)		
wage share by industry			0.289 (0.221)	0.362+ (0.094)
lr_wshare_by_industry				0.020 (0.281)
Constant	-1.976** (0.911)	-0.317 (0.759)	-1.660** (0.744)	-1.318** (0.628)
Observations	4351	4580	4351	4580
R2	0.15	0.04	0.18	0.08

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.7 – Verdoorn's Law in Total Manufacturing (Rowthorn1 specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wage growth	0.110 (0.109)	0.178 (0.123)		
employment growth	0.449* (0.231)	0.406 (0.245)	-0.025 (0.235)	-0.349 (0.999)
productivity difference growth	-0.164* (0.090)	-0.310*** (0.099)	-0.026 (0.066)	0.001 (0.152)
L.value added growth	-0.067 (0.050)	-0.133** (0.056)	-0.091 (0.056)	-0.305*** (0.110)
D.Manufacturing share of value added	0.066+ (0.011)		0.072+ (0.010)	
Manufacturing share of value added		0.032*** (0.010)		0.018 (0.011)
lr_VA_share_manuf		0.030*** (0.011)		0.015* (0.008)
lr__cons		-0.286 (0.293)		-4.531** (2.134)
lr_g_EMP		0.383* (0.224)		-1.272 (1.705)
lr_g_GAP		-0.273*** (0.089)		0.036 (0.133)
lr_g_VA_Q		-1.133+ (0.056)		-1.305+ (0.110)
lr_g_real_wages		0.246* (0.127)		
wage share by industry			-0.388*** (0.117)	-0.712*** (0.255)
lr_wshare_by_industry				-0.682** (0.292)
Constant	0.150 (0.126)	-0.270 (0.320)	-1.059* (0.613)	-3.754** (1.450)
Observations	437	437	437	437
R2	0.03	0.17	0.03	0.08

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.8 – Verdoorn's Law in Total Manufacturing (Rowthorn1 specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
productivity difference (log)	0.027 (0.109)	-0.531** (0.234)	-0.040 (0.153)	-0.702** (0.302)
LD2.value added (log)	0.040 (0.032)		0.016 (0.026)	
L.value added (log)		0.028 (0.053)		0.069 (0.056)
D.persons employed (1000, log)	0.238 (0.147)		0.202 (0.153)	
persons employed (1000, log)		0.490+ (0.108)		0.629+ (0.150)
D.real wages (log)	0.152*** (0.052)			
real wages (log)		0.067 (0.062)		
D.Manufacturing share of value added	0.060+ (0.009)		0.064+ (0.010)	
Manufacturing share of value added		0.038+ (0.007)		0.028*** (0.010)
lr_VA_share_manuf		0.042+ (0.009)		0.035*** (0.011)
lr__cons		0.440 (1.614)		-0.972 (1.680)
lr_ln_EMP		0.489+ (0.121)		0.630+ (0.142)
lr_ln_GAP		-0.610** (0.297)		-0.719** (0.278)
lr_ln_VA_Q		-0.972+ (0.053)		-0.931+ (0.056)
lr_ln_real_wages		0.046 (0.077)		
D.wage share by industry			-0.074 (0.136)	
wage share by industry				-0.415+ (0.110)
lr_wshare_by_industry				-0.524+ (0.139)
Constant	0.400 (1.349)	0.087 (1.352)	-0.757 (1.383)	-0.816 (1.339)
Observations	324	360	324	360
R2	0.04	0.04	0.05	0.04

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.9 – Verdoorn's Law in Manufacturing Sub-sectors (Rowthorn1 specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wage growth	0.273*** (0.090)	0.342+ (0.074)		
employment growth	0.971+ (0.284)	0.988+ (0.270)	0.863** (0.378)	0.791** (0.389)
productivity difference growth	-0.321*** (0.106)	-0.320+ (0.077)	-0.166+ (0.039)	-0.126** (0.052)
L.value added growth	-0.129+ (0.027)	-0.148+ (0.026)	-0.202+ (0.032)	-0.197+ (0.028)
D.Manufacturing share of value added	0.024* (0.014)		-0.026 (0.033)	
Manufacturing share of value added		0.018** (0.009)		-0.011 (0.030)
lr_VA_share_manuf		0.006 (0.012)		-0.004 (0.026)
lr_cons		2.073*** (0.691)		0.604 (3.692)
lr_g_EMP		0.757*** (0.275)		0.640* (0.331)
lr_g_GAP		-0.303+ (0.077)		-0.089** (0.045)
lr_g_VA_Q		-1.148+ (0.026)		-1.197+ (0.028)
lr_g_real_wages		0.257 (0.186)		
wage share by industry			-0.495+ (0.102)	-0.518+ (0.085)
lr_wshare_by_industry				-0.407+ (0.086)
Constant	0.632 (0.610)	1.589** (0.740)	-0.746 (2.907)	1.113 (4.638)
Observations	5757	5757	5757	5757
R2	0.17	0.14	0.22	0.16

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.10 – Verdoorn's Law in Manufacturing Sub-sectors (Rowthorn1 specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wages (log)	0.313+ (0.044)	0.358+ (0.045)		
productivity difference (log)	-0.306+ (0.040)	-0.360+ (0.054)	-0.293+ (0.045)	-0.311+ (0.044)
L.value added (log)	0.341+ (0.038)	0.039 (0.029)	0.355+ (0.036)	0.121+ (0.029)
D.persons employed (1000, log)	0.392+ (0.091)		0.236+ (0.054)	
persons employed (1000, log)		0.665+ (0.091)		0.663+ (0.084)
D.Manufacturing share of value added	0.026*** (0.009)		0.015 (0.010)	
Manufacturing share of value added		0.042+ (0.010)		0.030** (0.014)
lr_VA_share_manuf		0.045+ (0.012)		0.064 (0.040)
lr__cons		-0.281 (1.283)		5.777 (5.247)
lr_ln_EMP		0.722+ (0.109)		-0.519 (1.025)
lr_ln_GAP		-0.405+ (0.078)		-0.036 (0.253)
lr_ln_VA_Q		-0.961+ (0.029)		-0.879+ (0.029)
lr_ln_real_wages		0.465+ (0.065)		
wage share by industry			-0.627+ (0.075)	-0.685+ (0.067)
lr_wshare_by_industry				-0.207 (0.425)
Constant	-0.235 (0.890)	0.331 (1.238)	-0.252 (1.093)	-0.223 (1.235)
Observations	4040	4040	4040	4040
R2	0.14	0.13	0.14	0.11

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.11 – Verdoorn's Law in All Main Sectors (Rowthorn1 specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wage growth	0.356+ (0.032)	0.364+ (0.031)		
employment growth	0.643+ (0.056)	0.555+ (0.068)	0.454+ (0.064)	0.494+ (0.067)
productivity difference growth	-0.200+ (0.035)	-0.226+ (0.031)	-0.240+ (0.035)	-0.260+ (0.037)
L.value added growth	-0.076*** (0.024)	-0.096+ (0.025)	-0.179+ (0.024)	-0.173+ (0.027)
D.Manufacturing share of value added	-0.005 (0.004)		0.002 (0.005)	
Manufacturing share of value added		-0.005 (0.004)		-0.005 (0.004)
lr_VA_share_manuf		-0.006 (0.008)		0.016 (0.014)
lr_cons		0.343 (0.266)		1.029* (0.592)
lr_g_EMP		0.851** (0.358)		0.600+ (0.145)
lr_g_GAP		-0.270+ (0.068)		-0.252+ (0.047)
lr_g_VA_Q		-1.096+ (0.025)		-1.173+ (0.027)
lr_g_real_wages		0.460+ (0.096)		
wage share by industry			-0.428+ (0.105)	-0.682+ (0.144)
lr_wshare_by_industry				-0.532** (0.231)
Constant	0.168+ (0.049)	0.105 (0.090)	0.361 (0.221)	0.346 (0.301)
Observations	7106	7106	7106	7106
R2	0.15	0.16	0.18	0.17

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.12 – Verdoorn's Law in All Main Sectors (Rowthorn1 specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wages (log)	0.172*** (0.053)	0.334+ (0.037)		
productivity difference (log)	-0.333+ (0.073)	-0.432+ (0.060)	-0.365+ (0.075)	-0.377+ (0.048)
LD.value added (log)	-0.436+ (0.032)		-0.356+ (0.029)	
L.value added (log)		0.018 (0.034)		0.077*** (0.028)
D.persons employed (1000, log)	0.414+ (0.103)		0.314+ (0.062)	
persons employed (1000, log)		0.572+ (0.064)		0.580+ (0.051)
D.Manufacturing share of value added	-0.013* (0.007)		-0.001 (0.006)	
Manufacturing share of value added		-0.004 (0.006)		-0.006 (0.004)
lr_VA_share_manuf		0.007 (0.013)		0.003 (0.015)
lr_cons		-0.944 (3.173)		3.798** (1.538)
lr_ln_EMP		0.769+ (0.141)		0.744+ (0.123)
lr_ln_GAP		-0.553+ (0.149)		-0.525+ (0.085)
lr_ln_VA_Q		-0.982+ (0.034)		-0.923+ (0.028)
lr_ln_real_wages		0.454+ (0.124)		
wage share by industry			-0.749+ (0.153)	-0.631+ (0.121)
lr_wshare_by_industry				-0.668** (0.319)
Constant	-1.398 (1.510)	2.101** (0.921)	2.424** (0.964)	2.109*** (0.659)
Observations	4351	4580	4351	4580
R2	0.16	0.05	0.13	0.07

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.13 – Verdoorn's Law in Total Manufacturing (Rowthorn2 specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wage growth	0.069 (0.101)	0.188 (0.114)		
employment growth	-0.546*** (0.199)	-0.697*** (0.233)	-1.053+ (0.288)	-1.337 (0.983)
productivity difference growth	-0.171* (0.094)	-0.325*** (0.103)	-0.047 (0.076)	-0.075 (0.131)
L.g_gdpperworker	-0.060 (0.045)	-0.144** (0.072)	-0.141*** (0.051)	-0.291+ (0.083)
D.Manufacturing share of value added	0.065+ (0.010)		0.069+ (0.008)	
Manufacturing share of value added		0.035*** (0.010)		0.020 (0.014)
lr_VA_share_manuf		0.032+ (0.009)		0.019** (0.009)
lr__cons		-0.331 (0.297)		-4.119** (1.671)
lr_g_EMP		-0.483* (0.256)		-1.989 (1.546)
lr_g_GAP		-0.299*** (0.111)		-0.027 (0.102)
lr_g_gdpperworker		-1.144+ (0.072)		-1.291+ (0.083)
lr_g_real_wages		0.359* (0.194)		
wage share by industry			-0.420*** (0.133)	-0.762*** (0.256)
lr_wshare_by_industry				-0.636** (0.265)
Constant	0.136 (0.120)	-0.259 (0.339)	-1.592** (0.627)	-3.961*** (1.280)
Observations	437	437	437	437
R2	0.03	0.17	0.03	0.08

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.14 – Verdoorn's Law in Total Manufacturing (Rowthorn2 specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
productivity difference (log)	-0.104 (0.164)	-0.489** (0.244)	-0.261 (0.166)	-0.804** (0.400)
LD.productivity (log)	-0.013 (0.045)		-0.050 (0.049)	
L.productivity (log)		0.008 (0.059)		-0.027 (0.067)
D.persons employed (1000, log)	-0.681+ (0.116)		-0.638+ (0.110)	
persons employed (1000, log)		-0.457+ (0.089)		-0.303* (0.167)
D.real wages (log)	0.075* (0.044)			
real wages (log)		0.071 (0.063)		
D.Manufacturing share of value added	0.060+ (0.008)		0.057+ (0.011)	
Manufacturing share of value added		0.040+ (0.006)		0.025* (0.014)
lr_VA_share_manuf		0.043+ (0.007)		0.034*** (0.012)
lr__cons		0.287 (1.566)		0.025 (1.995)
lr_ln_EMP		-0.522+ (0.119)		-0.432** (0.176)
lr_ln_GAP		-0.528* (0.268)		-0.631** (0.291)
lr_ln_gdpperworker		-0.992+ (0.059)		-1.027+ (0.067)
lr_ln_real_wages		0.074 (0.067)		
D.wage share by industry			-0.329*** (0.112)	
wage share by industry				-0.376*** (0.121)
lr_wshare_by_industry				-0.355*** (0.129)
Constant	0.871 (1.226)	0.077 (1.344)	-1.944* (1.096)	-0.402 (1.708)
Observations	342	360	342	360
R2	0.05	0.07	0.04	0.06

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.15 – Verdoorn's Law in Manufacturing Sub-sectors (Rowthorn2 specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wage growth	0.266*** (0.088)	0.345+ (0.071)		
employment growth	0.007 (0.323)	-0.079 (0.290)	-0.312 (0.320)	-0.169 (0.400)
productivity difference growth	-0.311*** (0.105)	-0.272+ (0.074)	-0.167+ (0.041)	-0.146+ (0.044)
L.g_gdpperworker	-0.112+ (0.029)	-0.126+ (0.026)	-0.202+ (0.026)	-0.191+ (0.025)
D.Manufacturing share of value added	0.020 (0.014)		-0.030 (0.038)	
Manufacturing share of value added		0.012 (0.009)		-0.022 (0.033)
lr_VA_share_manuf		0.122 (0.089)		0.086 (0.105)
lr__cons		-4.697 (6.551)		-38.442 (38.998)
lr_g_EMP		-1.383 (1.140)		-2.011 (1.746)
lr_g_GAP		-0.337+ (0.102)		0.092 (0.260)
lr_g_gdpperworker		-1.126+ (0.026)		-1.191+ (0.025)
lr_g_real_wages		0.436 (0.283)		
wage share by industry			-0.492+ (0.089)	-0.568+ (0.087)
lr_wshare_by_industry				0.447 (1.015)
Constant	1.134 (0.917)	2.168** (1.001)	-1.930 (2.933)	-0.661 (3.836)
Observations	5757	5757	5757	5757
R2	0.18	0.15	0.27	0.21

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.16 – Verdoorn's Law in Manufacturing Sub-sectors (Rowthorn2 specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wages (log)	0.433+ (0.043)	0.352+ (0.048)		
productivity difference (log)	-0.336+ (0.042)	-0.360+ (0.054)	-0.393+ (0.049)	-0.334+ (0.046)
L.productivity (log)	0.196+ (0.031)	-0.005 (0.034)	0.242+ (0.031)	0.054* (0.029)
D.persons employed (1000, log)	-0.136 (0.089)		-0.377+ (0.052)	
persons employed (1000, log)		-0.360+ (0.092)		-0.276*** (0.091)
D.Manufacturing share of value added	0.033+ (0.008)		0.016* (0.009)	
Manufacturing share of value added		0.034+ (0.010)		0.025* (0.015)
lr_VA_share_manuf		-0.132 (0.178)		0.075+ (0.022)
lr__cons		4.710 (4.594)		-0.095 (1.892)
lr_ln_EMP		1.676 (2.185)		-0.562*** (0.182)
lr_ln_GAP		-0.928 (0.585)		-0.224* (0.119)
lr_ln_gdpperworker		-1.005+ (0.034)		-0.946+ (0.029)
lr_ln_real_wages		0.687*** (0.259)		
wage share by industry			-0.774+ (0.079)	-0.641+ (0.074)
lr_wshare_by_industry				-0.779+ (0.137)
Constant	-0.093 (0.806)	0.942 (1.278)	0.149 (1.060)	-0.037 (1.222)
Observations	4040	4040	4040	4040
R2	0.13	0.13	0.12	0.10

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.17 – Verdoorn's Law in All Main Sectors (Rowthorn2 specification, growth rates, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wage growth	0.332+ (0.032)	0.357+ (0.030)		
employment growth	-0.401+ (0.057)	-0.396+ (0.063)	-0.605+ (0.067)	-0.548+ (0.063)
productivity difference growth	-0.177+ (0.043)	-0.234+ (0.042)	-0.217+ (0.035)	-0.233+ (0.036)
L.g_gdpperworker	-0.082+ (0.024)	-0.111+ (0.025)	-0.147+ (0.022)	-0.153+ (0.024)
D.Manufacturing share of value added	-0.008* (0.005)		0.005 (0.005)	
Manufacturing share of value added		-0.005 (0.003)		-0.003 (0.004)
lr_VA_share_manuf		-0.018 (0.025)		-0.012 (0.010)
lr_cons		0.184 (0.540)		1.013 (1.032)
lr_g_EMP		0.812 (0.960)		-0.194 (0.638)
lr_g_GAP		-0.090 (0.134)		-0.266+ (0.065)
lr_g_gdpperworker		-1.111+ (0.025)		-1.153+ (0.024)
lr_g_real_wages		-0.120 (0.403)		
wage share by industry			-0.389+ (0.085)	-0.650+ (0.113)
lr_wshare_by_industry				-0.698** (0.280)
Constant	0.151** (0.071)	0.186* (0.099)	0.386* (0.217)	0.661*** (0.250)
Observations	7106	7106	7106	7106
R2	0.11	0.12	0.14	0.13

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

Table B.18 – Verdoorn's Law in All Main Sectors (Rowthorn2 specification, logarithms, 23 countries)

	real wages		wage share	
	(1) Dynamic CCE	(2) CS-ARDL	(3) Dynamic CCE	(4) CS-ARDL
real wages (log)	0.311+ (0.032)	0.266+ (0.047)		
productivity difference (log)	-0.434+ (0.060)	-0.449+ (0.062)	-0.437+ (0.051)	-0.365+ (0.049)
L.productivity (log)	0.146+ (0.032)		0.250+ (0.032)	0.017 (0.024)
D.persons employed (1000, log)	-0.139* (0.075)		-0.216+ (0.056)	
persons employed (1000, log)		-0.587*** (0.178)		-0.399+ (0.052)
D.Manufacturing share of value added	-0.003 (0.005)		-0.002 (0.004)	
Manufacturing share of value added		-0.005 (0.009)		-0.004 (0.004)
L.g_gdpperworker		-0.034 (0.025)		
lr_VA_share_manuf		-0.067 (0.065)		-0.006 (0.008)
lr__cons		1.637 (2.987)		2.480*** (0.940)
lr_g_gdpperworker		-1.034+ (0.025)		
lr_ln_EMP		-0.473* (0.274)		-0.393*** (0.135)
lr_ln_GAP		-0.400+ (0.110)		-0.314+ (0.079)
lr_ln_real_wages		0.165* (0.099)		
wage share by industry			-0.711+ (0.167)	-0.678+ (0.151)
lr_ln_gdpperworker				-0.983+ (0.024)
lr_wshare_by_industry				-0.346 (0.526)
Constant	0.649 (0.906)	3.340* (1.841)	1.789*** (0.635)	1.919*** (0.705)
Observations	4580	4580	4580	4580
R2	0.06	0.04	0.08	0.07

* p < 0.1 ** p < 0.05, *** p < 0.01, + p < 0.001; standard errors in parentheses.

3777 Appendix **C**

3778 Primary Literature Used In MRA On The
3779 Bhadhuri-Marglin Model (Chapter III)

Primary Literature Used In MRA On The Bhadhuri-Marglin Model (Chapter III)

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INCOME DISTRIBUTION, PRODUCTIVITY AND STAGNATION An Alternative to the 'Secular Stagnation'-Narrative

Abstract

Since the Global Financial Crisis in 2007, mainstream economics debate has revolved around the possibility of 'secular stagnation', that is, a prolonged period of no or very low GDP growth. Adherents of the secular stagnation-narrative usually find possible explanations in imperfect capital markets, demographic change and capital-saving rather than capital-using innovations. The aim of the present PhD thesis is to present an alternative to the secular stagnation-narrative, by connecting income distribution, demand and productivity. We argue that increasing income inequality led to lower aggregate demand and productivity. Stagnation is not secular but human-made and measures can be taken to combat it. Chapter I is dedicated to Verdoorn's law – the link between output growth and productivity growth. While the overwhelming majority of empirical studies finds statistically significant and positive results for Verdoorn's law, there is no consensus about its magnitude. Using meta regression analysis (MRA) on 52 studies with 665 estimations of Verdoorn's law, we find no publication bias and statistically significant meta-averages for Verdoorn's law in all specifications used by Verdoorn (1949), Kaldor (1975), and Rowthorn (1975). Apart from Rowthorn's first specification, all used specifications yield Verdoorn coefficients between 0.44 and 0.69 which indicate increasing returns to scale.

Chapter II estimates Verdoorn's law and the Marx-Webb effect based on data for 23 EU28 members for the period 1995-2017 using the EU-KLEMS data set (Stehrer et al. 2019). As EU-KLEMS separates by sector, the panel data analysis can differentiate between manufacturing and non-manufacturing sectors. Our contribution to the existing literature consists in 1) the use of auto-regressive distributed lag (ARDL) models, in order to separate between short-run Okun effects and long-run Verdoorn effects. Another contribution lies in the fact that, contrary to most of the available literature on Verdoorn's law and the Marx-Webb effect, the analysis undertaken controls for potential cross-sectional dependence. Again, our analysis finds statistically significant Verdoorn coefficients – between 0.378 and 0.966 – and statistically significant Marx-Webb effects – between 0.193 and 0.315.

Chapter III again uses meta-regression analysis to provide an overview of the literature on the Bhadhuri-Marglin model. Most industrial countries have experienced a long-term fall in the wage share since the 1970s. Thus, there has been a shift in the functional distribution from wages to profits with consequences for economic growth. The overall strength of the approach consists in presenting a compromise between the neo-Kaleckian and neo-Goodwinian views of how changes in income distribution affect economic growth. The estimation results can thus be directly used for policy recommendations and are thus (at least amongst heterodoxy) subject to great debates. Two problems arise out of this. First, there is a strong split between wage-led and profit-led country results which are assumed to be partly explained by differences in estimation methodology. Therefore, there exists a need for a definitive answer how strongly these differences affect the overall outcome. This meta-regression analysis assesses 34 studies with 494 empirical estimates for domestic and total demand. Here, the MRA finds indications of small-magnitude publication bias in favour of wage-led demand regimes. More precisely, the average country is found to be wage-led when analysing domestic demand and profit-led in the case of total demand.

Keywords: wages, productivity, wage-led, profit-led, verdoorn's law, meta-regression analysis, marx-webb effect

Centre d'Économie de Paris-Nord (UMR CNRS 7234-CEPN)

Résumé

Depuis la crise financière mondiale de 2007, le débat économique dominant s'articule autour de la possibilité d'une "stagnation séculaire", c'est-à-dire une période prolongée de croissance nulle ou très faible du PIB. Les partisans de la stagnation séculaire trouvent généralement des explications possibles dans l'imperfection des marchés des capitaux, les changements démographiques et les innovations qui économisent le capital plutôt que de l'utiliser.

L'objectif de cette thèse de doctorat est de présenter une alternative au récit de la stagnation séculaire, en reliant la distribution des revenus, la demande et la productivité. Nous soutenons qu'inégalité croissante des revenus entraîne une baisse de demande globale et la productivité. La stagnation n'est pas séculaire mais d'origine humaine et des mesures peuvent être prises pour la combattre. Le chapitre I est consacré à la loi de Verdoorn – le lien entre la croissance de la production et la croissance de la productivité. Si l'écrasante majorité des études empiriques semble trouver des résultats statistiquement significatifs et positifs pour la loi de Verdoorn, il n'y a pas de consensus à propos de son ampleur. En utilisant une méta-analyse (MRA) sur 52 études avec 665 estimations de la loi de Verdoorn, nous ne trouvons aucun biais de publication et des méta-moyennes statistiquement significatives pour la loi de Verdoorn dans toutes les spécifications utilisées par VERDOORN (1949), KALDOR (1975) et ROWTHORN (1975). Hormis la première spécification de Rowthorn, toutes les spécifications utilisées donnent des coefficients de Verdoorn compris entre 0,44 et 0,69 qui indiquent des rendements d'échelle croissants.

Le chapitre II estime la loi de Verdoorn et l'effet Marx-Webb sur la base des données de 23 membres de l'UE28 pour la période 1995-2017 en utilisant l'ensemble de données EU-KLEMS (STEHNER et al. 2019). Comme EU-KLEMS permet l'analyse par secteur, l'analyse des données de panel peut différencier les secteurs manufacturiers et non manufacturiers. Notre contribution à la littérature existante consiste en 1) l'utilisation de modèles ARDL (auto-régressive distributed lag), afin de séparer les effets Okun à court terme des effets Verdoorn à long terme. Une autre contribution réside dans le fait que, contrairement à la plupart de la littérature disponible sur la loi de Verdoorn et l'effet Marx-Webb, l'analyse entreprise contrôle la dépendance transversale potentielle. Encore une fois, notre analyse trouve des coefficients de Verdoorn statistiquement significatifs – entre 0,38 et 0,97 – et des effets Marx-Webb statistiquement significatifs – entre 0,19 et 0,32.

Le chapitre III utilise à nouveau la méta-régression pour donner un aperçu de la littérature sur le modèle de Bhadhuri-Marglin. La plupart des pays industriels ont connu une baisse de la part des salaires depuis les années 1970. Il y a donc eu une déformation du partage de la valeur ajoutée en faveur des profits, avec des conséquences sur la croissance économique. L'originalité de notre approche consiste à présenter un compromis entre les points de vue néo-Kaleckien et néo-Goodwinien sur la façon dont les changements dans la distribution des revenus affectent la croissance économique. Les résultats de l'estimation peuvent donc être directement utilisés pour des recommandations politiques et sont donc sujets de grands débats. Deux problèmes en découlent (au moins parmi les hétérodoxes). Tout d'abord, il existe un fort clivage entre les résultats des pays tirés par les salaires et ceux des pays tirés par les bénéfices, qui s'expliquerait en partie par des différences dans la méthodologie d'estimation. Il est donc nécessaire d'apporter une réponse tranchée à la question de la mesure dans laquelle ces différences affectent le résultat global. Cette analyse de méta-régression évalue 34 études avec 494 estimations empiriques pour la demande intérieure et totale. Ici, la méta-régression trouve des indications d'un biais de publication de faible ampleur en faveur des régimes de demande tirés par les salaires. Plus précisément, on constate que le pays moyen est wage-led lorsqu'on analyse la demande intérieure et profit-led dans le cas de la demande totale.

Mots clés : salaires, productivité, wage-led, profit-led, loi de verdoorn, analyse méta-régression, effet marx-webb

