

UNIVERSITY OF HOHENHEIM

FACULTY OF BUSINESS, ECONOMICS AND SOCIAL SCIENCES



HOHENHEIM DISCUSSION PAPERS
IN BUSINESS, ECONOMICS AND SOCIAL SCIENCES

Research Area INEPA

DISCUSSION PAPER **13**-2017

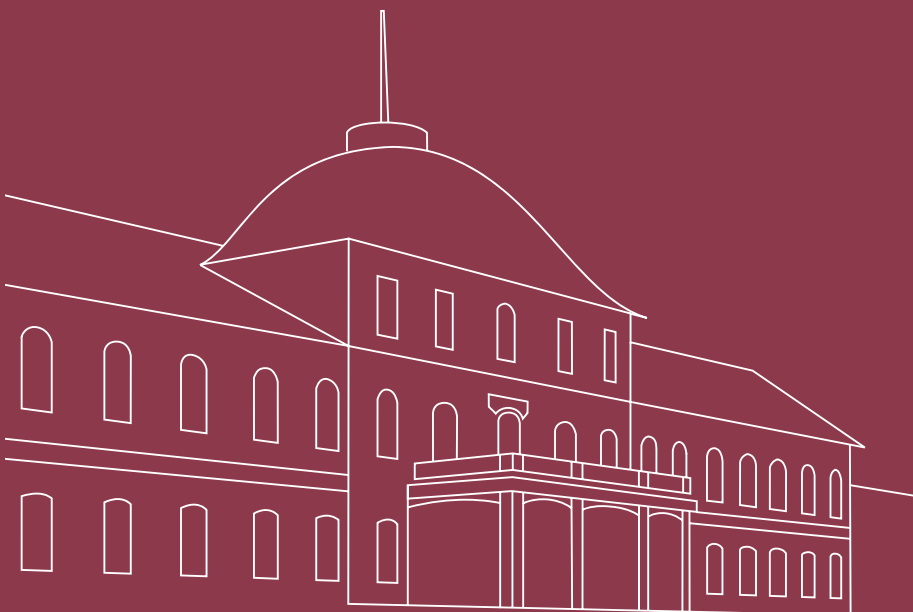
**SPATIAL DIFFERENCES IN STUNTING AND
HOUSEHOLD AGRICULTURAL PRODUCTION IN
SOUTH AFRICA: (RE-) EXAMINING THE LINKS
USING NATIONAL PANEL SURVEY DATA**

Steffen Otterbach

University of Hohenheim

Michael Rogan

Rhodes University



www.wiso.uni-hohenheim.de

Discussion Paper 13-2017

Spatial differences in stunting and household agricultural production in South African: (re-)examining the links using national panel survey data

Steffen Otterbach, Michael Rogan

Research Area “INEPA – Inequality and Economic Policy Analysis”

Download this Discussion Paper from our homepage:

<https://wiso.uni-hohenheim.de/papers>

ISSN 2364-2076 (Printausgabe)
ISSN 2364-2084 (Internetausgabe)

Die Hohenheim Discussion Papers in Business, Economics and Social Sciences dienen der schnellen Verbreitung von Forschungsarbeiten der Fakultät Wirtschafts- und Sozialwissenschaften. Die Beiträge liegen in alleiniger Verantwortung der Autoren und stellen nicht notwendigerweise die Meinung der Fakultät Wirtschafts- und Sozialwissenschaften dar.

Hohenheim Discussion Papers in Business, Economics and Social Sciences are intended to make results of the Faculty of Business, Economics and Social Sciences research available to the public in order to encourage scientific discussion and suggestions for revisions. The authors are solely responsible for the contents which do not necessarily represent the opinion of the Faculty of Business, Economics and Social Sciences.

Spatial differences in stunting and household agricultural production in South Africa: (re-)examining the links using national panel survey data

STEFFEN OTTERBACH¹ AND MICHAEL ROGAN²

Abstract

One explanation for the increasing prevalence of stunting in South Africa over the past 15 years while other development indicators have improved is that Big Food retail chains have been contributing to a low quality diet across the country, particularly in poor urban households. We thus use nationally representative longitudinal data (2008–2014) to trace 6 years of stunting's evolution among South African children, adolescents, and young adults aged 0–19, with particular attention to how the prevalence of under-nutrition differs between urban and rural areas and how the drivers of poor nutrition vary spatially. The results of our random-effects logistic regressions on the nutritional impact of household agricultural production suggest that, conditional on household income, subsistence farming is associated with a lower probability of stunting. Even more important, although under-nutrition retains a strong spatial component, once observable differences in living standards are controlled for, the higher tendency for children in deep rural households to suffer from (severe) stunting reverses.

Keywords: Stunting, height for age, malnutrition, anthropometric measures, subsistence farming, nutritional inequality, South Africa

JEL Classification: I14, I15, O15, O18, O55

¹ Institute for Health Care & Public Management, University of Hohenheim, Stuttgart, Germany.

² Institute of Social and Economic Research (ISER), Rhodes University, Grahamstown, South Africa.

This analysis uses anonymized unit record data from the South African National Income Dynamics Study (NIDS, implemented and managed by the Southern Africa Labour and Development Research Unit (SALDRU) based at the University of Cape Town's School of Economics. Steffen Otterbach gratefully acknowledges the support provided by the Faculty of Business, Economics, and Social Sciences at the University of Hohenheim within the research area Inequality and Economic Policy Analysis. The authors would also like to thank Vadim Kufenko, Hamid Oskorouchi, Klaus Prettnner, and Alfonso Sousa-Poza for valuable comments and discussion.

1. Introduction

South Africa is one of only a handful of countries in which the prevalence of child stunting has increased over the period during which progress towards the Millennium Development Goals (MDGs) has been monitored (Hendriks, 2014; Hendriks et al., 2016). In fact, stunting, which serves as a marker for chronic malnutrition and/or poor maternal health, is more widespread in the country than acute malnutrition as measured by wasting (Faber and Wenhold, 2007). Not only does stunting affect about 20% of South African children aged 0–5 (Labadarios et al., 2008), but just over a third of the children who died in the country’s hospitals between 2005 and 2009 were severely malnourished (Bamford, 2011). Stunting has a number of long-term impacts on health and may be irreversible in children older than two (Bhutta et al., 2008; Lo et al., 2017).

One of the puzzles in the South African context is that the prevalence of malnourishment and low nutritional diversity has persisted (or even increased) during the expansion of the government’s social protection program (from 2002 onwards), which has improved household food security substantially (Devereux and Waidler, 2017; Hendriks, 2013; Hendriks, 2014; Pienaar and von Fintel, 2014; Ryan and Leibbrandt, 2015). This period also coincided with the introduction of the national program for prevention of mother-to-child HIV transmission (Barron et al., 2013), which would have been expected to decrease the prevalence of child stunting (Bailey et al., 1999). Major factors in explaining this persistence despite progress in other developmental indicators and expanded programs to address high levels of HIV infection include dietary diversity, food security, access to agricultural lands, food prices and differentials, and access to commercial food retailers. Hence, the South African literature (e.g., Walsh and van Rooyen, 2015) tends to focus on certain differences in nutritional status between urban and rural regions.

Three positive developments associated with the post-apartheid period – decreasing income poverty (related to an expanded social grant system), declining hunger levels, and improved access to service delivery – have been more pronounced in rural parts of South Africa (Pienaar and von Fintel, 2014; Zimbalist, 2017). Yet the available empirical evidence (Govender et al., 2017; Tibesigwa and Visser, 2015) is mixed in terms of how under-nutrition risk is likely to differ between urban and rural areas and how the drivers of poor nutrition may vary spatially. On the one hand, measures of dietary diversity suggest that households in deep rural areas tend to consume monotonous, low nutrition diets (Govender et al., 2017; Labadarios et al., 2011; Schmidt and Vorster, 1995), with some studies indicating poorer diversity in households farther away from supermarkets (Labadarios et al., 2011). Residents of rural areas also tend to have a

lower intake of micronutrients than their urban counterparts (Mchiza et al., 2015). These findings are not necessarily surprising given that rural areas, and particularly those designated “Black homelands”³ during the apartheid era, are still defined by high levels of poverty and multiple deprivation (see Noble and Wright, 2013).

On the other hand, an emerging strand of the literature identifies access to Big Food⁴ and the higher prices of healthier food items, particularly in poor urban areas, as two of the problems accounting for the rise in non-communicable diseases (NCDs) in South Africa. In fact, a recent comprehensive review of dietary intake (Mchiza et al., 2015) points to evidence of a nutrition transition in the nation, with Black Africans in urban areas, particularly, reporting greater intakes of fat and added sugar. In addition to the well-documented public health challenges of obesity and under-nutrition in South Africa (Igumbor et al., 2012), some research also shows an association between higher income and the ongoing switch to a high fat diet with low nutritional value (MacIntyre et al., 2002). Certain of these trends coincided with a fairly remarkable increase between 2005 and 2010 in the consumption of processed, packaged, and otherwise unhealthy food (Igumbor et al., 2012). This increase has in turn been accompanied by the rapid expansion of large supermarket retailers into all segments of the South African market (D’Haese and van Huylbroek, 2005; Igumbor et al., 2012; Kroll, 2016; Louw et al., 2007) including rural areas.

It therefore remains unclear whether the increase in child stunting is of greater concern for rural households because they are poorer and have less access to basic services (e.g., clean water and sanitation) and fresh food from large retailers or whether malnutrition may be mitigated in rural areas by lower exposure to Big Food and the nutrition transition’s negative aspects, as well as by the ability to improve food diversity through food production. This latter issue of household agricultural production’s role in addressing food security and improving nutrition is the subject of some debate in both the broader development and the South African literature. Whereas some work is relatively sceptical of these claims (Bradstock, 2005; De Swardt, 2003; Misselhorn, 2005; Palmer and Sender, 2006; Sender, 2002, 2012), a handful of studies presents direct evidence of household production’s benefits for nutrition in South Africa (Hendriks, 2003; Kirsten et al., 1998; van Averebeke and Khosa, 2007).

³ The 1951 Bantu Authorities Act established 10 areas as homelands for South Africa’s Black African population. These homelands, now a part of South Africa, are often characterized as “deep rural”, with higher levels of subsistence farming than other parts of the country (Noble and Wright, 2013; Pienaar and von Fintel, 2014; Rogan and Reynolds, 2017).

⁴ This term refers to the large global food and beverage industry and its increasingly concentrated market power and distribution networks (PLoS Medicine Editors, 2012).

One key gap in the literature, however, is how household production explains some of the spatial differences in child health and nutrition in South Africa. For example, Hendricks et al. (2016: 93), with specific reference to low nutritional levels in rural areas, suggest that “it is not known whether [the nutrition transition leading to stunting and obesity] is exaggerated in poor rural areas, and even less is understood about how infusions of cash in the form of grants and the introduction of other social protection measures interact with subsistence farming to influence household food security strategies and nutrition outcomes”. Whereas recent research addresses the issue of household food security strategies (see von Fintel and Pienaar, 2016), no evidence is yet forthcoming on nutritional outcomes.

In this paper, therefore, we build on the extant literature by using six years of the nationally representative longitudinal South African National Income Dynamics Study (NIDS) to explore the association between child stunting, urban-rural differences, and household agricultural production. The advantage of this data set is that it includes an unusually rich set of socio-economic and demographic variables, which enables us to isolate the associations between child stunting outcomes, spatial variables, and household agricultural activities.

We structure the remaining discussion as follows. Section 2 discusses key nutritional indicators (particularly, child stunting) in South Africa and identifies how these differ across the spatial categories used in national household surveys. Given our focus on agriculture and nutrition in South Africa’s rural areas, the section also gives an overview of the spatial trends in poverty, food security, multiple deprivations, and service delivery during the post-apartheid period, as well as commercial retail’s growing market penetration over the past decade and its link to poor health outcomes. It concludes by reviewing the international and South African literature on the link between household agricultural production and nutrition. Section 3 then describes the NIDS data and our key analytic variables and outlines our empirical strategy. Section 4 reports the results of two analytic phases; the first, a descriptive analysis of household agricultural production activities and trends in stunting (our key long-term nutrition indicator) by province and area type, and the second, a set of random effects logistic regressions identifying the association between child stunting and household production while controlling for a rich set of socioeconomic and demographic variables. Section five concludes the paper with a discussion of the results.

2. Literature

2.1. Child nutrition

Despite recent progress in poverty reduction and improved food security, child health and malnutrition in South Africa remains a serious concern: although a middle income country, the prevalence of stunting (15.4%) and severe stunting (3.8%) is high (Shisana et al., 2013). Moreover, although it is not uncommon for the prevalence of stunting to improve more slowly than other developmental indicators (e.g., poverty and hunger) in the context of economic growth and rising income levels (Iannotti et al., 2009; World Bank, 2008; Ruel et al., 2013), South Africa is one of just 12 countries worldwide (and the only nation in the Southern African Development Community region) in which this prevalence actually increased⁵ in the 2000s (Hendriks, 2014; Hendriks et al., 2016; Labadarios et al., 2008; Shisana et al., 2013).

Patterns of child stunting in South Africa have a strong spatial element, an issue on which we focus in the empirical section of our paper. In general, rates of stunting are highest in rural provinces and in the deep rural areas that have borne the brunt of apartheid era spatial planning in terms of both relative isolation and underdevelopment (Labadarios et al., 2011). The risk of stunting is also subject to gender and spatial differences, with boys from rural informal (non-governmentally planned) areas having a higher risk (23.2%) than boys from urban informal areas (17%) but girls in urban informal areas having the highest stunting prevalence (20.9%) followed by girls in rural informal areas (17%) (Shisana et al., 2013: 206). These data, however, are from the South African National Health and Nutrition Examination Survey whose sample sizes are too small to allow statistical inference. The strongest claim that can be made, therefore, is that both boys and girls from urban formal areas experience significantly lower levels of stunting (Shisana et al., 2013). This conclusion also fits well with the broader South African literature, which suggests that children in deep rural areas are more likely to experience malnutrition and a lack of dietary diversity (see Labadarios et al., 2011).

2.2. The nutrition transition

A different perspective on stunting, and one that has received less attention in the South African literature, involves two related terms: “hidden hunger” and the already referenced “nutrition transition”. Hidden hunger refers to a situation in which food availability is sufficient to prevent hunger (i.e., basic food security needs are met in terms of caloric intake) but food quality is low in terms of micronutrients and dietary diversity. The latter is exemplified by the Bangladesh context in which a rise in stunting prevalence alongside improved food security has

⁵ Not all studies support this finding (e.g., May and Timaeus, 2014), but a recent review of the evidence for South Africa (Devereux and Waidler, 2017) suggests that, at the very least, there has been no progress in reducing child stunting since 1994 (the first year of democracy).

probably resulted from persistent hidden hunger caused by poor quality diet and micronutrient deficiencies (Iannotti et al., 2009). Relatedly, the nutrition transition refers to a shift away from traditional foods to the so-called Western diet of “more energy-dense, processed foods, more foods of animal origin, and more added sugar, salt and fat” (Spires et al., 2016: 35).

One of the chief causes of stunted growth in South Africa’s children from a nutritional perspective is the low diversity maize-based diet consumed in both rural and poor urban households (Hendriks et al., 2016). An additional aspect is this diet’s association with the comorbidity of stunted growth and obesity in children (Hendriks et al., 2016). This association, which is relatively well-documented in the broader literature, is often referred to as the “double burden” of malnutrition (Igumbor et al., 2012; Lipton, 2013). Nonetheless, the evidence on the spatial features of both hidden hunger and the nutrition transition in South Africa remains inconclusive. On the one hand, some studies imply (Battersby and Peyton, 2014) or demonstrate (Igumbor et al., 2012) that the spike in unhealthy and highly processed food consumption is an urban phenomenon, with much of this work suggesting that the food transition and its associated negative outcomes have been concentrated in South Africa’s urban areas (Battersby and Peyton, 2014). Igumbor et al. (2012: 6), for example, identify rapid urbanization, concentrated ownership of food production and distribution, and food trade globalization as key contributors to the nutrition transition in South Africa. One important feature of this phenomenon is that healthier food options tend to cost more (as much as 10 to 110 percent more according to some estimates) than healthier foods in large commercial supermarket chains (Battersby and Peyton, 2014; Igumbor et al., 2012; Spires et al., 2016; Temple et al., 2011). At the same time, some of these developments have been accompanied by rapid expansion of large supermarket retailers into all segments of the South African market (D’Haese and van Huylenbroek, 2005; Igumbor et al., 2012; Kroll, 2016; Louw et al., 2007), which expansion has itself coincided with a fairly remarkable increase between 2005 and 2010 in the consumption of processed, packaged, and otherwise unhealthy food (Igumbor et al., 2012).

On the other hand, some research claims that dietary diversity is far lower in rural provinces and in the tribal areas (Labadarios et al., 2011), linked partly to an income- monotonous diet association by which higher income⁶ households tend to have more diverse dietary intakes (Labadarios et al., 2011) while rural households are much more likely to be poor (Noble and Wright, 2013; Rogan and Reynolds, 2017). Moreover, although food prices have increased consistently over the past several years (Devereux and Waidler, 2017), they are highest in areas

⁶ Obviously, this relation is not always linear, and there is also evidence that higher income and wealth levels are associated with a high fat, generally unhealthy, so-called modern diet (MacIntyre et al., 2002).

where poor households are located (Labadarios et al., 2011). There is also evidence that, due partly to such government interventions as the subsidization and sometimes VAT exemption of staples like maize and bread, high energy basics are often cheaper than unprocessed foods (including fruits and vegetables) and thus more popular in poorer communities (Mchiza et al., 2015). Hence, contrary to the narrative of the nutrition transition being associated with supermarket purchased foods, other work demonstrates that households situated far away from supermarkets (e.g., those in rural areas) have lower levels of dietary diversity (Labadarios et al., 2011). When households in these rural areas (and to some extent in poor urban areas) do access commercial food retailers, they typically purchase unhealthy food, which may actually accelerate the nutrition transition and contribute to malnutrition through a lack of dietary diversity even in the face of access to supermarkets (Spires et al., 2016).

2.3. Spatial trends in poverty, food security, and multiple deprivations

Not only food consumption and nutrition but also important post-apartheid changes in poverty, food security, and material deprivation exhibit a strong spatial dimension. For example, the well-documented expansion of the government's non-contributory means-tested social grant system (in the form of cash transfers) was more concentrated in rural parts of South Africa. Under this scheme, between 1997 and 2012, the percentage of rural households receiving at least one monthly government cash transfer more than doubled while the percentage of urban grant receiving households increased by only 58 percent (Zimbalist, 2017). Largely as a result of this expansion and extension of the cash transfer program, poverty decreased relatively more in rural areas over the post-apartheid period (Zimbalist, 2017). One key outcome associated with this decrease is the drastic reduction in the percentage of households (both rural and urban) experiencing hunger. Whereas hunger levels have traditionally been higher in rural areas, a sharper reduction in rural areas (the former Black homelands in particular) from the early to mid-2000s, meant that, by 2008, the differences in hunger levels between homeland and non-homeland regions had been erased (Pienaar and von Fintel, 2014). Perhaps most significant, a key mechanism for the convergence of hunger levels across these area types has been the facilitation of household agricultural production by the expansion of cash transfers (von Fintel and Pienaar, 2016).

In addition to the reduction of income poverty and hunger, one of the most marked improvements in rural (relative to urban) areas has been the rapid increase in access to clean (piped) water, electricity, and telephones. Increases in access to these basic services have been far more substantial in rural areas (more than doubling in the case of electricity and telephone) than in urban areas where improvements have been more measured and from a much higher

base (see Zimbalist, 2017). Yet despite this encouraging progress, the rural former homelands remain far poorer and suffer from a significantly higher level of multiple deprivations (including income, employment, education, living conditions, and health) relative to the rest of South Africa (Noble and Wright, 2013). In short, the spatial legacy of apartheid remains intact despite some important progress in service delivery and the injection of cash transfers into rural households (Noble and Wright, 2013; Pienaar and von Fintel, 2014).

2.4. Household agricultural production and nutrition

Given the progress in rural South Africa in poverty reduction and improved food security together with the potential role of household agricultural production (Pienaar and von Fintel, 2014; Rogan and Reynolds, 2017), the link between agriculture and nutrition is a natural focus in the context of high levels of child stunting. Nevertheless, internationally, the evidence on the impact of either household or small-scale subsistence agricultural production (Berti et al., 2004) or agricultural intervention (Ruel et al., 2013; World Bank, 2008) on child and maternal nutrition is inconclusive, making the former particularly the subject of long-time debate (Lunven, 1982; Ramírez, 2002; Smitasiri, 2001; von Braun and Kennedy, 1986). Even in studies that do identify an association between subsistence agriculture and child anthropometry, the effects tend to be quite small (Ruel et al., 2013). Hence, in general, although these reviews (Pinstrup-Andersen, 2013; Ruel, 2001; Ruel et al., 2013; World Bank, 2008) outline a clear conceptual link between household agriculture and nutrition (see Ruel et al., 2013; World Bank, 2008), establishing an empirical association between household production activities or interventions and nutrition remains elusive.

Naturally, there are exceptions, although three of the most comprehensive studies showing an empirical link between household agricultural production and nutrition are by no means recent. For example, Shack et al. (1990), in their now seminal work on household agriculture and nutrition in Papua New Guinea, show that cash crop income allows households to supplement traditional diets with energy- and protein-dense purchased foods, which has a positive impact on child nutrition. Likewise, some of the more detailed empirical work demonstrating the link between subsistence agriculture and child nutrition, again in Papua New Guinea, associates both more intense and diverse small-scale agricultural activities and household income with improved child nutrition (Mueller et al., 2001a, 2001b). More recent evidence of a positive impact on nutrition comes from an evaluation of a homestead agricultural support package in Bangladesh (Iannotti et al., 2009).

South Africa, as a middle-income country, has relatively lower levels of subsistence agriculture than many of the developing countries addressed in the literature. Mueller et al.

(2001), for example, note that about 85 percent of households in Papua New Guinea depend on subsistence farming. The empirical base for South Africa is also thin, with only a handful of studies attempting to demonstrate a link between household production and nutrition⁷. Perhaps the most detailed of these (Kirsten et al., 1998) is not only from two decades ago but based on only a small number of households (79) in one province. This research does, however, provide evidence that household agricultural production improves nutrition but only in households for which agriculture is a serious activity, which implies that community gardens and purely subsistence agricultural activities are not linked to improved nutrition (see also Hendriks, 2003). Such a conclusion inherently obscures the possibility of a dual causality in which some of the more successful households at farming may also have higher levels of nutrition and a more diverse diet.

Other work from South Africa, although more recent, is based on samples that are not only small but very narrow in geographic focus (Adekunle et al., 2014; Hendriks, 2003; Modi et al., 2006; van Averbek and Khosa, 2007). The most recent (Hendriks et al. 2016) does provide some evidence that household production is associated with greater dietary diversity, but the bivariate analysis (again based on a small sample size) is methodologically weak. Nonetheless, the empirical work for South Africa, although limited, does provide some indication that subsistence agriculture is associated either directly or indirectly with a higher intake of nutrient dense foods when households produce these foods themselves or grow staples and then redirect household resources towards the purchase of animal products and fresh fruit and vegetables (Govender et al., 2017; Schmidt and Vorster, 1995; van Averbek and Khosa, 2007). To date, however, there is no analysis of the link between child stunting (or the broader issue of nutrition) and household production based on a large scale nationally representative survey. As a result, the relative risks (and determinants) of malnutrition in urban and rural areas remain largely unexplored.

3. Methodology

3.1. Data

Our dataset comprises the first four waves of South Africa's first nationally representative panel survey (SALDRU, 2016a, 2016b, 2016c, 2016d), the South African National Income Dynamics Study (NIDS).⁸ The initial wave (2008) was administered to about 28,000 individuals in 7,300 households, designated as continuing sample members (CSM), a group that includes

⁷ The empirical basis for the association between household production and food security (Aliber and Hart, 2009; Devereux and Waidler, 2017; Pienaar and von Fintel, 2014; Rogan and Reynolds, 2017) is much stronger.

⁸ For more information on the NIDS, see Chinhema et al. (2016).

children born or adopted into the original survey households. In the subsequent waves, administered every two years, new individuals entered the survey if and only if they were co-residing with an original CSM and were therefore labelled temporary sample members (TSM). Because NIDS is designed to follow CSMs and their co-residents during the time of cohabitation, the sample size increases over time, to around 34,000, 37,000, and 42,000 individuals in waves 2, 3, and 4, respectively.

3.2. Sample

The NIDS provides height for age z -scores, the central measure for our study, for children, adolescents, and young adults aged 0 to 19 years. We thus limit our analysis to this age group for initial samples of 9,321, 8,485, 12,635, and 15,384 individuals in waves 1, 2, 3, and 4, respectively.

3.3. Anthropometric measurement of stunting

With the assistance of a qualified nurse, fieldworkers received training on how to measure height and other anthropometric factors, including how to measure babies' and young children's (< 24 months) height in the recumbent position. Two height measurements were taken and averaged, and if these differed by more than one centimeter, a third measure was taken to calculate the height for age z -scores. These latter were based on age in days and on the WHO international child growth standards (WHO, 2006) for children aged 5 and younger and the WHO standards for children and adolescents (De Onis et al., 2007) for individuals over 5. (Severe) stunting was defined as (3) 2 standard deviations below the growth standard median, with z -scores of >6 and <-6 considered biologically implausible and excluded from the analysis. Our dependent variable is thus binary (yes/ no), indicating whether a respondent is or is not (severely) stunted.

3.4. Explanatory variables

One of our main explanatory variables is aggregated household income, used to reflect a household's regular monthly income net of taxes. The derived income variable is an aggregate of different income sources, including labour market income; government grants and other government payments (e.g., unemployment insurance fund, workmen's compensation); interest, dividend, and rental income; remittances; subsistence agriculture; and imputed rental income from owner-occupied houses. Total household income is deflated using the monthly national headline consumer price index with November 2014 as the base month (*Statistics South Africa*, 2017). Lastly, we construct the natural logarithm of real equivalized net household income, adjusted to household structure using the modified OECD scale (Hagenaars et al., 1994).

Our main variable of interest is a dummy variable indicating whether a household is engaged in farming activities that are not part of paid employment, such as growing food or raising livestock. Also important is geographic classification of residence, provided in NIDS based on the 2011 census (SALDRU, 2014), which also describes infrastructure, level of service delivery, and market access, as well as density of and distance to hospitals and doctors. We therefore include a set of dummy variables for whether the respondent lives in a traditional, farming, or urban area (reference category). Whereas traditional areas are closely associated with the Black homelands of the apartheid era and remain under the jurisdiction of traditional leaders (see Noble and Wright, 2013), urban settlements are continuously built-up areas such as cities, towns, townships, small towns, and hamlets. Farming areas are locations in which land is allocated and used for commercial farming.

In addition to household income, we also control for several socio-economic and socio-demographic variables at the individual and household level, including gender, population group, gender and educational level of household head, and number of employed persons in the household. We also control at the household level for living conditions that might directly affect respondent and child health, including diarrheal diseases caused by inadequate access to water and sanitation (Prüss-Ustün et al., 2014). The model thus includes variables for whether the respondent lives in a household with access to a flush toilet, tap water, electricity, and whether refuse and rubbish are removed on a regular basis.

3.5. Econometric analysis

Our binary dependent variable requires a non-linear probability model, which can also account for the longitudinality of the data. At the same time, our interest in multiple time-constant explanatory variables (e.g., population group and gender) precludes the use of a fixed-effects (FE) logistic estimator. Moreover, as FE logistic regressions are estimated via conditional maximum likelihood, the estimation sample is limited to observations exhibiting within-person changes in the response variable which contribute to this likelihood. Given that “almost all stunting takes place within the first 1,000 days after conception” (Black et al., 2013) and may be irreversible later in life, such within-person changes in stunting are almost exclusively observable only in babies and very young children (<24 months). Given our additional interest in the prevalence and determinants of stunting in older individuals (aged 0 to 19) – for which we expect no substantial within-person changes in the response variable – we estimate random effects logistic regressions that allow inclusion of both time-variant and time-constant variables. These regressions also allow for unobserved heterogeneity but with the

stronger assumption of no correlation with our explanatory variables. Our random effects logistic regression model can thus be formulated as

$$\ln\left(\frac{\Pr(y_{it} | \beta, x_{it}, \gamma, z_i, \theta_t, u_i)}{1 - \Pr(y_{it} | \beta, x_{it}, \gamma, z_i, \theta_t, u_i)}\right) = \beta_0 + \beta x_{it} + \gamma z_i + \theta_t + u_i$$

where x_{it} is the time-variant and z_i the time-constant explanatory variables, θ_t denotes a set of survey year indicators, and u_i is the unit-specific error term. Unlike panel estimators for continuous dependent variables, binary response models focus on probabilities; they are thus inherently stochastic and seldom contain an idiosyncratic error (ε_{it}) that varies over time (Andreß et al., 2013).

4. Results

One important initial insight from the weighted descriptive statistics for the prevalence of (severe) stunting (both pooled sample and disaggregated by survey year and province) is that the nationwide prevalence decreased substantially from 17% in 2008 to 12% in 2014 but increased to about 20% in both 2010 and 2012 (see Table 1). The table also reveals substantial differences in both levels and trends of stunting across provinces. Although in most provinces the prevalence of (severe) stunting decreased between 2008 and 2014, it remained at high levels in the largely rural provinces of the Northern and Eastern Cape, the Free State, and the North West, with an actual increase in these latter two. Although the 2008–2012 increases in both stunting and severe stunting conform closely to the findings from key studies on nutrition in South Africa, the noticeable decrease in 2014 is something of an anomaly.⁹

Focusing on the descriptive trends in the 2008–2012 period, the relative increases in stunting and severe stunting are similar in both the deep rural (traditional) and urban areas at 16 and 19 percent, and 35 and 36 percent, respectively. These increases, however, grew from a much higher base in the traditional areas. The table also suggests that the convergence in the

⁹ This anomaly is not necessarily a problem for our empirical strategy because we are interested in the relation between subsistence agriculture and stunting. We do note, however, that there are several plausible explanations for the relatively rapid decrease in stunting prevalence between the last two waves of NIDS. First, the outcomes could reflect survey attrition which, if correlated with stunting risk itself, would not be corrected by the post-stratification survey weights. Second, the decrease could also reflect delayed reaction to the social grant expansion and corresponding decreases in hunger levels. It is likely, for example, that a number of CSMs from the panel survey moved out of the 0–19 cohort during the 2014 wave and did not benefit from the expanded social protection system at ages 0–5. They were thus more likely to be at risk for malnutrition and hunger at crucial stages in their development.

prevalence of malnutrition (proxied by stunting) between rural and urban areas did not occur in the same way as the well-documented convergence in hunger levels.

Table 1 about here

The weighted descriptive statistics for all analytic covariates over the six-year time span further reveal a slight increase in real equivalized household income, from about R3,400 in 2008 to R3,900 in 2014 (see Table 2). The share of the population involved in subsistence farming decreased substantially (24% in 2008) in the two waves subsequent to the initial wave (11% and 10%) and then increased again (17%) in 2014. At the same time, the geographic classification reflects a migration tendency from traditional and farming areas to the cities. For example, in 2008, the fraction of the sample living in traditional (urban) areas was 44% (51%), which decreased (increased) to 41% (56%) in 2014. Focusing specifically on changes over the six-year time span further reveals improved educational levels, with a decreasing share of household heads who have no or only some primary schooling and an increased enrolment in secondary schooling and higher education. At the same time, in line with the well-documented expansion of basic services over the 2008–2014 period, we also note improved living conditions in terms of access to tap water, a flush toilet, electricity, and a waste disposal system. Nonetheless, the average number of employed persons in the household increased only marginally, reflecting the persistently high levels of unemployment and large dependency on social grants in the country.

Table 2 about here

For the multivariate random effects logistic regression models, we run two different specifications for each stunting measure (Table 3). For specifications 1 and 2 (stunting), the coefficients on household income are significant and negative, supporting the expectation that higher income will be associated with a lower probability of stunting. That is, although it remains unclear whether and to what extent higher income leads to healthier and higher priced food choices, income is the main determinant of access to food and a greater variety of food choices. As regards the variable of most interest to this study, involvement in subsistence farming, we again find a significantly negative impact on the probability of stunting, which supports the intuitive assumption that agricultural involvement improves access to food by providing an additional food source. At the same time, although it is less clear whether and to

what extent subsistence farming may lead to greater dietary diversity, the negative association between subsistence farming and stunting probability could indicate a diet that is, to a lesser degree, based on either packaged or processed food or a monotonous diet devoid of fresh food.

Given that deep rural traditional areas are associated with high levels of poverty, unemployment, and material deprivation, it is not surprising that we initially find a positive and significant coefficient for specification 1; that is, a higher probability of stunting in traditional areas even after income is controlled for. Once we add in controls for living conditions (specification 2), however, the direction of the association reverses while still remaining significant. In other words, once we control for the detrimental effects of poor living conditions, living in traditional areas poses a significantly lower risk of stunting. Most important, the size and direction of the association between subsistence farming and stunting remains the same in the second specification. Thus, once income, living conditions, and a large set of covariates are controlled for, involvement in agricultural activities for household consumption is a significant protector against stunting. Taken together, these results are consistent with the hypothesis that rural households may be less exposed to the nutrition transition and the negative aspects of Big Food. They may even be able to enhance their dietary diversity through access to wild food.

The analytic results further suggest that females are less likely to be stunted whereas gender of the household head appears to have no statistically significant effect. As regards population groups, Whites have a significantly lower probability of being stunted than Black Africans (reference group), Coloureds are significantly more likely to be stunted, while Indians/Asians exhibit a non-significant negative effect. The probability of stunting also decreases with education level, significantly so for a household head with some type of secondary schooling or higher education compared to the no schooling reference but only insignificantly for primary schooling.

In the case of severe stunting (specifications 3 and 4), for most control variables, the direction and size of the estimated coefficients are very similar to those using (non-severe) stunting as the dependent variable (see Table 3). However, certain confounding variables – such as living in a traditional or farming area, having secondary schooling, or having access to a flush toilet – are not significant in specification 4. In both specifications, being White has a positive but insignificant coefficient. It is also important to note that rho – the total error variance due to unobserved heterogeneity – is much lower in the severe stunting specifications than in those for (non-severe) stunting (about 38% vs. 53%). Rho can also be interpreted as the serial correlation that remains in the dependent variable after all explanatory variables are controlled for because of person-specific unobserved heterogeneity (Andreß, Golsch, and

Schmidt, 2013: 241). More broadly, however, the key finding from the stunting specifications is also observable in the severe stunting specifications: once living conditions (i.e., access to basic services) are controlled for, the higher risk of severe stunting in deep rural traditional areas disappears. At the same time, the apparent protective effect of subsistence agriculture remains in both severe stunting specifications.

Table 3 about here

5. Discussion and Conclusions

Not only is stunting endemic in South Africa but there is sparse evidence of any improvement over the past 20 years. This lack of progress is particularly worrying given that South Africa, as a middle-income country, has made important strides over recent years in service delivery, access to clean water, expansion of social security protection, and reduction of hunger levels. South Africa even ranks highest on the Hunger and Nutrition Commitment Index Africa¹⁰ for its efforts to combat food insecurity and undernutrition. Why then has stunting persisted and possibly even worsened despite these efforts and widespread recognition of the condition’s long-term developmental impacts (Lo et al., 2017)?

Some of the more recent contributions to the South African literature argue that the problem is not simply the lack of food associated with stunting and other forms of malnutrition or undernourishment but rather the quality of the food available to households in poor areas (both urban and rural). This work is particularly interested in the role of Big Food in creating a food system in South Africa that offers poorer households affordable food products with very little nutritional value (Igumbor et al., 2012; Ledger, 2016). To date, however, the empirical evidence for these claims remains both thin and inclusive given some research claims that access to large supermarket chains protects against under-nutrition by improving dietary diversity.

This paper adds to the literature by exploring the prevalence of stunting through the lens of spatial differences and subsistence agriculture, both of which we propose as crude proxies for the level of interaction with large supermarket retailers. Our key finding is that once household income and a range of other covariates are controlled for, children, adolescents, and young adults in households that engage in subsistence agriculture are significantly less likely to suffer

¹⁰ <http://africa.hancindex.org/>

from stunting or severe stunting. Although only suggestive, these findings are consistent with the argument that households that purchase their food from large retailers are more likely to experience the negative effects of the nutrition transition.

Nevertheless, even after multiple factors are controlled for, the risk of stunting remains higher in deep rural areas – particularly those demarcated as Black homelands under apartheid. In fact, it is only when we control for access to basic services like sanitation and piped water that the higher risk of stunting in rural areas reverses (cf. Devereux and Waidler, 2017; Hammer and Spears, 2016; May and Timaeus, 2014; Mulmi et al., 2016; Vyas et al., 2016). This finding is crucial in its implication that once we control for the more obvious and observable sources of deprivation for rural households, children in these households are actually at a significantly lower risk of stunting than their urban counterparts.

In terms of our contribution to the larger body of international literature on small-scale agriculture, we claim merely that our findings suggest ways in which households disconnected from the Big Food system in South Africa may be partially protected from reliance on the empty high energy calorie foods that are generally affordable (see Ledger, 2016). Hence, while careful not to promote an over-romanticized notion that subsistence agriculture or home gardening is the solution to undernutrition and its effects in South Africa, we cannot ignore the possibility that such activities could play into this solution. Unfortunately, as yet, South Africa has no formal food security policy, with any legislative mention tending to be abstract and disjointed (Hendriks, 2014) and related policy to date being somewhat fragmented, with interventions falling across sectors from education (in the form of school feeding schemes) to social development to agriculture. Policy also tends to frame nutrition as a “rural and food production issue” (Hendriks, 2014; Spires et al., 2016: 38) even though a subsistence farming solution places the responsibility for nutrition largely on poor rural households while detracting from larger development and public health issues. Not only have no attempts yet been made to formally evaluate the existing food programs, but interventions frequently fail to differentiate between the indicators of nutrition and those of basic hunger. For example, whereas cash transfers play a large role in improving food security in South Africa (Devereux and Waidler, 2017), their monetary amounts are likely to be too small (and decreasing in real terms) to significantly improve dietary quality.

Hence, even though policies that make land available for small scale food production in South Africa certainly have their proponents (Labadarios et al., 2011), our findings are only broadly supportive of such an approach. In fact, despite pointing to the important role of subsistence agriculture, our analysis identifies several other factors capable of explaining urban

and rural area differences. One such difference is the likelihood of both stunting and severe stunting being higher in deep rural areas, a tendency that holds in our descriptive statistics but reverses when our regressions control for the multiple deprivations of income, education, and access to basic services. This observation is crucial because it implies a negative association between stunting risk and living in households located farther away from retail supermarket chains. Thus, rather than supporting the controversial idea of home gardens and similar subsistence activities as a policy solution to hunger and malnutrition, our results suggest that these activities may serve as a proxy for disconnection from a Big Food system that is actually quite harmful for poorer households.

References

- Adekunle, O.O., Monde, N., Agholor, I., Odeyemi, A.S., 2014. The role of home gardens in household food security in Eastern Cape: a case study of three villages in Nkonkobe Municipality. *J. Agric. Sci.* 6, 67–76.
- Aliber, M., Hart, T., 2009. Should subsistence agriculture be supported as a strategy to address rural food insecurity? *Agrekon* 48, 434-458.
- Andreß, H.-J., Golsch, K., Schmidt, A.W., 2013. *Applied Panel Data Analysis for Economic and Social Surveys*. Springer, Berlin.
- Bailey, R., Kamenga, M., Nsuami, M., Nieburg, P., St Louis, M., 1999. Growth of children according to maternal and child HIV, immunological and disease characteristics: a prospective cohort study in Kinshasa, Democratic Republic of Congo. *Int. J. Epidemiol.* 28, 532-540.
- Bamford, L., 2011. An overview of five years of child PIP data, in: Stephen, C., Bamford, L., Patrick, M., Wittenberg, D. (Eds.), *Saving Children 2009: Five Years of Data. A Sixth Survey of Child Health Care in South Africa*. Tshepesa Press, MRC, CDC, Pretoria.
- Barron, P., Pillay, Y., Doherty, T., Sherman, G., Jackson, D., Bhardwaj, S., Robinson, P., Goga, A., 2013. Eliminating mother-to-child HIV transmission in South Africa. *Bull. World Health Organ.* 91, 70-74.
- Battersby, J., Peyton, S., 2014. The geography of supermarkets in Cape Town: supermarket expansion and food access. *Urban Forum* 25, 153-164.
- Berti, P., Krasevec, J., Fitzgerald, S., 2004. A review of the effectiveness of agriculture interventions in improving nutrition outcomes. *Pub. Health Nutr.* 75, 599-609.
- Bhutta, Z., Ahmed, T., Black, R., Cousens, S., Dewey, K., Giugliani, E., Haider, B., Kirkwood, B., Morris, S., Sachdev, H., Shekar, M., 2008. What works? Interventions for maternal and child undernutrition and survival. *Lancet* 371, 417-440.
- Black, R.E., Victora, C.G., Walker, S.P., Bhutta, Z.A., Christian, P., De Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet* 382, 427-451.
- Bradstock, A., 2005. Changing livelihoods and land reform: evidence from the Northern Cape province of South Africa. *World Development* 33, 1979-1992.
- Chinhema, M., Brophy, T., Brown, M., Leibbrandt, M., Mlatsheni, C., Woolard, I., 2016. *National Income Dynamics Study Panel User Manual*. Southern Africa Labour and Development Research Unit, Cape Town
- D'Haese, M., van Huylbroek, G., 2005. The rise of supermarkets and changing expenditure patterns of poor rural households case study in the Transkei area, South Africa. *Food Policy* 30, 97-113.
- De Onis, M., Onyango, A., Borghi, E., Siyam, A., Nishida, C., Siekmann, J., 2007. Development of a WHO growth reference for school-aged children and adolescents. *Bull. World Health Organ.* 85, 660-667.
- De Swardt, C., 2003. *Unravelling chronic poverty in South Africa some food for thought*. International Conference on Chronic Poverty Research, University of Manchester.
- Devereux, S., Waidler, J., 2017. Why does malnutrition persist in South Africa despite social grants?, *Food Security SA Working Paper No.001*. DST-NRF Centre of Excellence in Food Security, South Africa.

- Faber, M., Wenhold, F., 2007. Nutrition in contemporary South Africa. *Water SA* 33, 393-400.
- Govender, L., Pillay, K., Siwela, M., Modi, A., Mabhaudhi, T., 2017. Food and nutrition insecurity in selected rural communities of KwaZulu-Natal, South Africa: linking human nutrition and agriculture. *Int. J. Environment. Res. Pub. Health* 14, 1-21.
- Hagenaars, A.J., De Vos, K., Zaidi, A.M., 1994. Poverty statistics in the late 1980s: research based on micro-data. Office for Official Publications of the European Community, Luxemburg.
- Hammer, J., Spears, D., 2016. Village sanitation and child health: effects and external validity in a randomized field experiment in rural India. *J. Health Econ.* 48, 135-148.
- Hendriks, S., 2003. The potential for nutritional benefits from increased agricultural production in rural KwaZulu-Natal. *S. Afr. J. Agr. Ext.* 32, 28-44.
- Hendriks, S., 2013. South Africa's National Development Plan and New Growth Path: reflections on policy contradictions and implications for food security. *Agrekon* 52, 1-17.
- Hendriks, S., 2014. Food security in South Africa: status quo and policy imperatives. *Agrekon* 53, 1-24.
- Hendriks, S., Viljoen, A., Marais, D., Wenhold, F., McIntyre, A., Ngidi, M., van der Merwe, C., Annandale, J., Kalaba, M., Stewart, D., 2016. The current rain-fed and irrigated production of food crops and its potential to meet the all-year-round nutritional requirements of rural poor people in North West, Limpopo, KwaZulu-Natal and the Eastern Cape, A report to the Water Research Commission. Institute for Food, Nutrition and Well-being, University of Pretoria, Pretoria.
- Iannotti, L., Cunningham, K., Ruel, M., 2009. Improving diet quality and micronutrient nutrition: homestead food production in Bangladesh, IFPRI Discussion Paper No. 00928. International Food Policy Research Institute (IFPRI), Washington, DC.
- Igumbor, E., Sanders, D., Puoane, T., Tsolekile, L., Schwarz, C., Purdy, C., Swart, R., Durao, S., Hawkes, C., 2012. "Big Food", the consumer food environment, health, and the policy response in South Africa. *PLOS Medicine* 9, 1-7.
- Kirsten, J., Townsend, R., Gibson, C., 1998. Determination of agricultural production to household nutritional status in KwaZulu-Natal, South Africa. *Development Southern Africa* 15, 573-587.
- Kroll, F., 2016. Foodways of the poor in South Africa: how value-chain consolidation, poverty and cultures of consumption feed each other, Working Paper No. 36. PLAAS, UWC and Centre of Excellence on Food Security, Cape Town.
- Labadarios, D., Steyn, N., Nel, J., 2011. How diverse is the diet of adult South Africans? *Nutr. J.* 10, 1-11.
- Labadarios, D., Swart, R., Maunder, E., Kruger, H., Gericke, G., Kuzwayo, P., Ntsie, P., Steyn, N., Schloss, I., Dhansay, M., Jooste, P., Dannhauser, A., Nel, J., Molefe, D., Kotze, T., 2008. National Food Consumption Survey-Fortification Baseline (NFCS-FB-I) South Africa, 2005. *S. Afr. J. Clin. Nutr.* 21, 245-300.
- Ledger, T., 2016. *An Empty Plate: Why We Are Losing the Battle for Our Food System*. Jacana Media, Johannesburg.
- Lipton, M., 2013. Staples production: efficient "subsistence" smallholders are key to poverty reduction, development, and trade, UNCTAD Global Commodities Forum 2013: Recommitting to commodity sector development as an engine of economic growth and poverty reduction, Geneva.

- Lo, S., Das, P., Horton, R., 2017. Early childhood development: the foundation of sustainable development. *Lancet* 389, 9-11.
- Louw, A., Vermeulen, H., Kirsten, J., Madevu, H., 2007. Securing small farmer participation in supermarket supply chains in South Africa. *Development Southern Africa* 24, 539-551.
- Lunven, P., 1982. The nutritional consequences of agricultural and rural development projects. *Food Nutr. Bull.* 4, 17-22.
- MacIntyre, U., Kruger, H., Venter, C., Vorster, H., 2002. Dietary intakes of an African population in different stages of transition in the North West Province, South Africa: the THUSA study. *Nutr. Res.* 22, 239-256.
- May, J., Timaeus, 2014. Inequities in under-five child nutritional status in South Africa: what progress has been made? *Development Southern Africa* 31, 761-774.
- Mchiza, Z., Steyn, N., Hill, J., Kruger, A., Schönfeldt, H., Nel, J., Wentzel-Viljoen, E., 2015. A review of dietary surveys in the adult South African population from 2000 to 2015. *Nutrients* 7, 8227-8250.
- Misselhorn, A., 2005. What drives food insecurity in southern Africa? A meta-analysis of household economy studies. *Global Environmental Change* 15, 33-43.
- Modi, M., Modi, A., Hendriks, S., 2006. Potential role for wild vegetables in household food security: a preliminary case study in Kwazulu-Natal, South Africa. *Afr. J. Food, Agr., Nutr. Dev.* 6, 1-13.
- Mueller, I., Vounatsou, P., Allen, B., Smith, T., 2001a. Spatial patterns of child growth in Papua New Guinea and their relation to environment, diet, socio-economic status and subsistence activities. *Ann. Hum. Biol.* 28, 263-280.
- Mueller, I., Vounatsou, P., Smith, T., Allen, B., 2001b. Subsistence agriculture and child growth in Papua New Guinea. *Ecol. Food Nutr.* 40, 367-395.
- Mulmi, P., Block, S., Shively, G., Masters, W., 2016. Climatic conditions and child height: sex-specific vulnerability and the protective effects of sanitation and food markets in Nepal. *Econ. Hum. Biol.* 23, 63-75.
- Noble, M., Wright, G., 2013. Using indicators of multiple deprivation to demonstrate the spatial legacy of apartheid in South Africa. *Soc. Indic. Res.* 112, 187-201.
- Palmer, K., Sender, J., 2006. Prospects for on-farm self-employment and poverty reduction: an analysis of the South African Income and Expenditure Survey 2000. *J. Contemp. Afr. Stud.* 24, 347-376.
- Pienaar, L., von Fintel, D., 2014. Hunger in the former apartheid homelands: determinants of convergence one century after the 1913 land act. *Agrekon* 53, 38-67.
- Pinstrup-Andersen, P., 2013. Can agriculture meet future nutrition challenges? *Eur. J. Dev. Res.* 25, 5-12.
- PLoS Medicine Editors, 2012. PLoS Medicine Series on Big Food: The Food Industry Is Ripe for Scrutiny. *PLoS Medicine* 9, e1001246.
- Prüss-Ustün, A., Bartram, J., Clasen, T., Colford, J.M., Cumming, O., Curtis, V., Bonjour, S., Dangour, A.D., De France, J., Fewtrell, L., 2014. Burden of disease from inadequate water, sanitation and hygiene in low-and middle-income settings: a retrospective analysis of data from 145 countries. *Trop. Med. Int. Health* 19, 894-905.

- Rami' rez, R., 2002. The effectiveness of small-scale agriculture interventions on household food security: a review of the literature, a report prepared for the Canadian FoodGrains Bank, Interpares, Partners for Development, Oxfam Canada, the Canadian International Development Agency and the International Development Research Centre, Ottawa.
- Rogan, M., Reynolds, J., 2017. Food poverty, hunger and household production in rural Eastern Cape households, REDI 3x3 Working Paper No. 29. Southern Africa Labour and Development Research Unit (SALDRU), University of Cape Town, Cape Town.
- Ruel, M., 2001. Can food-based strategies help reduce Vitamin A and iron deficiencies? A review of recent evidence, Food Policy Review No. 5. International Food Policy Research Institute (IFPRI), Washington, DC.
- Ruel, M., Alderman, H., Maternal and Child Nutrition Study Group, 2013. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? *Lancet* 382, 536–551.
- Ryan, J., Leibbrandt, M., 2015. Multidimensional food insecurity measurement, Southern Africa Labour and Development Research Unit Working Paper No. 160. SALDRU, University of Cape Town, Cape Town.
- SALDRU, 2014. Inclusion of Census 2011 geographic variables in NIDS. Southern Africa Labour and Development Research Unit (SALDRU), University of Cape Town, Cape Town.
- SALDRU, 2016a. National Income Dynamics Study 2008, Wave 1, Version 6.1 ed. DataFirst, Cape Town.
- SALDRU, 2016b. National Income Dynamics Study 2010-2011, Wave 2, Version 3.1 ed. DataFirst, Cape Town.
- SALDRU, 2016c. National Income Dynamics Study 2012, Wave 3 Version 2.1 ed. DataFirst, Cape Town.
- SALDRU, 2016d. National Income Dynamics Study 2014 - 2015, Wave 4 Version 1.1 ed. DataFirst, Cape Town.
- Schmidt, M., Vorster, H., 1995. The effect of communal vegetable gardens on nutritional status. *Develop. S. Afr.* 12, 713-724.
- Sender, J., 2002. Women's struggle to escape rural poverty in South Africa. *J. Agrar. Change* 2, 1-49.
- Sender, J., 2012. Fictions and elephants in the rondawel: a response to a brief chapter in South Africa's National Development Plan. *Transformation* 78, 98-114.
- Shack, K., Grivetti, L., Dewey, K., 1990. Cash cropping, subsistence agriculture, and nutritional status among mothers and children in lowland Papua New Guinea. *Soc. Sci. Med.* 31, 61-68.
- Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E., Naidoo, P., Hongoro, C., Mchiza, Z., Steyn, N., Dwane, N., Makoae, M., Maluleke, T., Ramlagan, S., Zungu, N., Evans, M., Jacobs, L., Faber, M., SANHANES-1 Team, 2013. South African National Health and Nutrition Examination Survey (SANHANES-1). HSRC Press, Cape Town.
- Smitasiri, S., 2001. A comment on how the nutritional impact of agricultural innovations can be enhanced. *Food Nutr. Bull.* 21, 503-506.
- Spires, M., Delobelle, P., Sanders, D., Puoane, T., Hoelzel, P., Swart, R., 2016. Diet-related non-communicable diseases in South Africa: determinants and policy responses, in: Padarath,

A., King, J., Mackie, E., Casciola, J. (Eds.), South African Health Review 2016. Health Systems Trust, Durban, pp. 35-42.

Statistics South Africa, 2017. Monthly national headline consumer price index, <http://www.statssa.gov.za/publications/P0141/CPIHistory.pdf>, Pretoria.

Temple, N., Steyn, N., Fourie, J., de Villiers, A., 2011. Price and availability of healthy food: a study in rural South Africa. *Nutrition* 27, 55-58.

Tibesigwa, B., Visser, M., 2015. Small-scale subsistence farming, food security, climate change and adaptation in South Africa: male-female headed households and urban-rural nexus, ERSA Working Paper No. 527. Economic Research Southern Africa (ERSA), Cape Town.

van Averbek, W., Khosa, T., 2007. The contribution of smallholder agriculture to the nutrition of rural households in a semi-arid environment in South Africa. *Water SA* 33, 413-418.

von Braun, J., Kennedy, E., 1986. Commercialization of subsistence agriculture: income and nutritional effects in developing countries, Working Paper on the Commercialization of Agriculture and Nutrition No. 1. International Food Policy Research Institute, Washington, DC.

von Fintel, D., Pienaar, L., 2016. Small-scale farming and hunger: the enabling role of social assistance programmes in South Africa's former homelands, ERSA Working Paper No. 647. Economic Research Southern Africa (ERSA), Cape Town.

Vyas, S., Kov, P., Smets, S., Spears, D., 2016. Disease externalities and net nutrition: evidence from changes in sanitation and child height in Cambodia, 2005–2010. *Econ. Hum. Biol.* 23, 235-245.

Walsh, C., van Rooyen, F., 2015. Household food security and hunger in rural and urban communities in the Free State Province, South Africa. *Ecol. Food Nutr.* 54, 118-137.

WHO, 2006. WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development. World Health Organization, Geneva.

World Bank, 2008. From agriculture to nutrition: pathways, synergies and outcomes, Report No. 40196-GLB., World Bank, Washington, DC.

Zimbalist, Z., 2017. Analysing post-apartheid poverty trends by geo-type, 1997–2012: the understated role of urbanisation and social grants. *Development Southern Africa* 34, 151-167.

Table 1
Stunting (%) by province/area and year

	All				
Stunting	waves	2008	2010	2012	2014
All Provinces	17.1	16.7	20.7	19.9	12.4
Western Cape	11.5	13.1	15.0	12.7	7.8
Eastern Cape	21.0	25.8	26.1	20.3	14.8
Northern Cape	20.1	22.5	18.6	21.4	18.2
Free State	18.3	16.6	19.6	19.5	17.1
KwaZulu-Natal	18.3	16.5	23.3	20.4	13.8
North West	17.0	13.1	17.5	20.6	16.3
Gauteng	14.5	13.9	16.4	18.5	9.8
Mpumalanga	15.6	13.3	16.4	23.2	9.4
Limpopo	19.1	15.9	24.2	23.5	13.3
Traditional	19.8	18.9	24.0	23.0	14.3
Urban	14.9	14.6	17.6	17.7	11.0
Farms	17.6	19.8	21.1	15.8	14.1
Severe stunting					
All Provinces	5.5	6.0	6.7	7.3	2.6
Western Cape	2.3	2.6	3.3	2.5	1.5
Eastern Cape	8.8	14.7	10.1	9.1	3.4
Northern Cape	5.1	4.8	5.4	6.3	4.1
Free State	3.6	2.1	5.1	4.6	2.6
KwaZulu-Natal	6.1	4.7	9.1	7.9	3.0
North West	5.0	3.0	6.1	8.9	2.4
Gauteng	4.2	4.9	3.7	6.7	1.8
Mpumalanga	5.5	5.2	4.4	9.9	2.1
Limpopo	5.7	5.5	6.9	7.3	3.6
Traditional	6.6	7.0	7.9	8.9	3.2
Urban	4.4	4.8	5.5	6.0	2.2
Farms	6.9	9.9	7.6	7.6	2.8

Note: National Income Dynamics Study (NIDS) data for participants aged 0-19 years weighted using post-stratification weights.

Table 2

Descriptive statistics: Means and standard deviations, weighted

Variable	All waves		Wave 1		Wave 2		Wave 3		Wave 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Stunting (yes/no)	0.171	0.38	0.167	0.37	0.207	0.40	0.199	0.40	0.124	0.33
Severe stunting (yes/no)	0.055	0.23	0.060	0.24	0.067	0.25	0.073	0.26	0.026	0.16
Equivalentized HH income	3113.908	6106.06	2391.377	5059.68	2584.396	4788.17	3187.563	6094.56	3898.244	7346.44
Real equivalentized HH income	3569.452	6865.34	3395.046	7015.40	3242.931	6012.56	3618.760	6921.25	3862.957	7225.34
Ln real equivalentized HH income	7.546	1.02	7.402	1.08	7.393	1.06	7.578	0.99	7.717	0.95
Subsistence farming (yes; ref.: no)	0.154	0.36	0.242	0.43	0.108	0.31	0.103	0.30	0.173	0.38
Geographic classification:										
Traditional	0.430	0.50	0.446	0.50	0.456	0.50	0.424	0.49	0.408	0.49
Urban	0.532	0.50	0.512	0.50	0.499	0.50	0.542	0.50	0.559	0.50
Farming	0.038	0.19	0.042	0.20	0.045	0.21	0.034	0.18	0.033	0.18
Female	0.503	0.50	0.502	0.50	0.510	0.50	0.499	0.50	0.501	0.50
HH head is female	0.640	0.48	0.525	0.50	0.628	0.48	0.729	0.44	0.643	0.48
HH head educational level										
No schooling	0.169	0.37	0.212	0.41	0.213	0.41	0.149	0.36	0.127	0.33
Primary school	0.265	0.44	0.313	0.46	0.283	0.45	0.231	0.42	0.250	0.43
Secondary school	0.429	0.49	0.370	0.48	0.397	0.49	0.476	0.50	0.446	0.50
Higher education	0.138	0.34	0.104	0.31	0.106	0.31	0.144	0.35	0.177	0.38
Number of employed persons in HH	1.058	1.04	1.002	1.01	0.916	0.98	1.068	1.06	1.184	1.07
Access to flush toilet	0.494	0.50	0.449	0.50	0.481	0.50	0.511	0.50	0.517	0.50
Access to tap water	0.879	0.33	0.856	0.35	0.888	0.32	0.889	0.31	0.880	0.32
Removal of refuse and rubbish	0.499	0.50	0.471	0.50	0.462	0.50	0.515	0.50	0.530	0.50
HH has electricity	0.831	0.37	0.791	0.41	0.769	0.42	0.857	0.35	0.876	0.33
Race (ref.: Black)	0.857	0.35	0.856	0.35	0.864	0.34	0.861	0.35	0.850	0.36
Coloured	0.076	0.27	0.075	0.26	0.073	0.26	0.075	0.26	0.080	0.27
Indian/Asian	0.018	0.13	0.020	0.14	0.017	0.13	0.016	0.12	0.019	0.14
White	0.049	0.22	0.049	0.22	0.046	0.21	0.048	0.21	0.051	0.22
Wave 1	0.208	0.41	1.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00

Wave 2	0.204	0.40	0.000	0.00	1.000	0.00	0.000	0.00	0.000	0.00
Wave 3	0.286	0.45	0.000	0.00	0.000	0.00	1.000	0.00	0.000	0.00
Wave 4	0.302	0.46	0.000	0.00	0.000	0.00	0.000	0.00	1.000	0.00
Western Cape	0.084	0.28	0.066	0.25	0.077	0.27	0.090	0.29	0.095	0.29
Eastern Cape	0.146	0.35	0.150	0.36	0.151	0.36	0.141	0.35	0.145	0.35
Northern Cape	0.022	0.15	0.022	0.15	0.018	0.13	0.023	0.15	0.023	0.15
Free State	0.052	0.22	0.051	0.22	0.050	0.22	0.055	0.23	0.050	0.22
KwaZulu-Natal	0.231	0.42	0.243	0.43	0.255	0.44	0.219	0.41	0.216	0.41
North West	0.053	0.22	0.059	0.23	0.051	0.22	0.050	0.22	0.053	0.22
Gauteng	0.212	0.41	0.210	0.41	0.201	0.40	0.215	0.41	0.219	0.41
Mpumalanga	0.089	0.29	0.089	0.29	0.082	0.27	0.093	0.29	0.090	0.29
Limpopo	0.112	0.31	0.111	0.31	0.114	0.32	0.114	0.32	0.108	0.31
Number of observations	43,314		7,986		8,256		12,335		14,737	

Note: National Income Dynamics Study (NIDS) data for participants aged 0-19 years weighted using post-stratification weights.

Table 3

Random effects logistic regression estimates on (severe) stunting: NIDS (2008-2014)

	Stunting				Severe stunting			
	(1)		(2)		(3)		(4)	
	<i>Coef</i>	<i>SE</i>	<i>Coef</i>	<i>SE</i>	<i>Coef</i>	<i>SE</i>	<i>Coef</i>	<i>SE</i>
Ln real equivalized HH income	-0.229***	0.027	-0.202***	0.028	-0.169***	0.036	-0.136***	0.037
Subsistence farming (yes; ref.: no)	-0.178***	0.048	-0.200***	0.049	-0.347***	0.069	-0.365***	0.070
Geographic classification (ref.: urban)								
Traditional	0.157***	0.060	-0.161**	0.081	0.136*	0.073	-0.116	0.103
Farming	0.071	0.096	-0.204*	0.106	0.121	0.118	-0.141	0.134
Population group (ref.: African)								
Coloured	0.337***	0.098	0.388***	0.099	0.274**	0.123	0.293**	0.124
Indian /Asian	-0.327	0.303	-0.159	0.304	-0.692	0.436	-0.557	0.435
White	-0.561**	0.254	-0.521**	0.254	0.121	0.302	0.105	0.303
Female	-0.451***	0.043	-0.449***	0.044	-0.371***	0.052	-0.371***	0.053
HH head is female	-0.048	0.041	-0.041	0.041	0.036	0.055	0.053	0.056
HH head educational level (ref.: no schooling)								
Primary school	-0.062	0.053	-0.038	0.053	0.016	0.066	0.047	0.067
Secondary school	-0.198***	0.053	-0.162***	0.054	-0.151**	0.068	-0.108	0.069
Higher education	-0.379***	0.084	-0.334***	0.085	-0.335***	0.117	-0.294**	0.118
Number of employed persons in HH	0.022	0.021	0.018	0.022	0.023	0.029	0.020	0.029
Access to flush toilet			-0.325***	0.071			-0.103	0.094
Access to tap water			-0.194***	0.054			-0.276***	0.069
Removal of refuse and rubbish			-0.063	0.068			-0.112	0.094
HH has electricity			-0.190***	0.050			-0.275***	0.063
Constant	-0.571**	0.228	-0.098	0.238	-2.529***	0.304	-2.079***	0.315
/lnsig2u	1.295***	0.046	1.298***	0.046	0.695***	0.092	0.702***	0.093
Number of observations		43,810		43,314		43,810		43,314
Number of groups		22,328		22,226		22,328		22,226
Rho		0.526		0.527		0.378		0.380
sigma_u		1.911		1.914		1.415		1.420
Chi ²		759.172		804.423		505.601		540.345
Degrees of freedom		24		28		24		28

Note: Regressions include survey year indicators and dummy variables at the province level. *** p<0.01, ** p<0.05, * p<0.1.

Hohenheim Discussion Papers in Business, Economics and Social Sciences

The Faculty of Business, Economics and Social Sciences continues since 2015 the established "FZID Discussion Paper Series" of the "Centre for Research on Innovation and Services (FZID)" under the name "Hohenheim Discussion Papers in Business, Economics and Social Sciences".

Institutes

510	Institute of Financial Management
520	Institute of Economics
530	Institute of Health Care & Public Management
540	Institute of Communication Science
550	Institute of Law and Social Sciences
560	Institute of Economic and Business Education
570	Institute of Marketing & Management
580	Institute of Interorganisational Management & Performance

Research Areas (since 2017)

INEPA	"Inequality and Economic Policy Analysis"
TKID	"Transformation der Kommunikation – Integration und Desintegration"
NegoTrans	"Negotiation Research – Transformation, Technology, Media and Costs"
INEF	"Innovation, Entrepreneurship and Finance"

Download Hohenheim Discussion Papers in Business, Economics and Social Sciences from our homepage: <https://wiso.uni-hohenheim.de/papers>

No.	Author	Title	Inst
01-2015	Thomas Beissinger, Philipp Baudy	THE IMPACT OF TEMPORARY AGENCY WORK ON TRADE UNION WAGE SETTING: A Theoretical Analysis	520
02-2015	Fabian Wahl	PARTICIPATIVE POLITICAL INSTITUTIONS AND CITY DEVELOPMENT 800-1800	520
03-2015	Tommaso Proietti, Martyna Marczak, Gianluigi Mazzi	EUROMIND-D: A DENSITY ESTIMATE OF MONTHLY GROSS DOMESTIC PRODUCT FOR THE EURO AREA	520
04-2015	Thomas Beissinger, Nathalie Chusseau, Joël Hellier	OFFSHORING AND LABOUR MARKET REFORMS: MODELLING THE GERMAN EXPERIENCE	520
05-2015	Matthias Mueller, Kristina Bogner, Tobias Buchmann, Muhamed Kudic	SIMULATING KNOWLEDGE DIFFUSION IN FOUR STRUCTURALLY DISTINCT NETWORKS – AN AGENT-BASED SIMULATION MODEL	520
06-2015	Martyna Marczak, Thomas Beissinger	BIDIRECTIONAL RELATIONSHIP BETWEEN INVESTOR SENTIMENT AND EXCESS RETURNS: NEW EVIDENCE FROM THE WAVELET PERSPECTIVE	520
07-2015	Peng Nie, Galit Nimrod, Alfonso Sousa-Poza	INTERNET USE AND SUBJECTIVE WELL-BEING IN CHINA	530

No.	Author	Title	Inst
08-2015	Fabian Wahl	THE LONG SHADOW OF HISTORY ROMAN LEGACY AND ECONOMIC DEVELOPMENT – EVIDENCE FROM THE GERMAN LIMES	520
09-2015	Peng Nie, Alfonso Sousa-Poza	COMMUTE TIME AND SUBJECTIVE WELL-BEING IN URBAN CHINA	530
10-2015	Kristina Bogner	THE EFFECT OF PROJECT FUNDING ON INNOVATIVE PERFORMANCE AN AGENT-BASED SIMULATION MODEL	520
11-2015	Bogang Jun, Tai-Yoo Kim	A NEO-SCHUMPETERIAN PERSPECTIVE ON THE ANALYTICAL MACROECONOMIC FRAMEWORK: THE EXPANDED REPRODUCTION SYSTEM	520
12-2015	Volker Grossmann Aderonke Osikominu Marius Osterfeld	ARE SOCIOCULTURAL FACTORS IMPORTANT FOR STUDYING A SCIENCE UNIVERSITY MAJOR?	520
13-2015	Martyna Marczak Tommaso Proietti Stefano Grassi	A DATA–CLEANING AUGMENTED KALMAN FILTER FOR ROBUST ESTIMATION OF STATE SPACE MODELS	520
14-2015	Carolina Castagnetti Luisa Rosti Marina Töpfer	THE REVERSAL OF THE GENDER PAY GAP AMONG PUBLIC-CONTEST SELECTED YOUNG EMPLOYEES	520
15-2015	Alexander Opitz	DEMOCRATIC PROSPECTS IN IMPERIAL RUSSIA: THE REVOLUTION OF 1905 AND THE POLITICAL STOCK MARKET	520
01-2016	Michael Ahlheim, Jan Neidhardt	NON-TRADING BEHAVIOUR IN CHOICE EXPERIMENTS	520
02-2016	Bogang Jun, Alexander Gerybadze, Tai-Yoo Kim	THE LEGACY OF FRIEDRICH LIST: THE EXPANSIVE REPRODUCTION SYSTEM AND THE KOREAN HISTORY OF INDUSTRIALIZATION	520
03-2016	Peng Nie, Alfonso Sousa-Poza	FOOD INSECURITY AMONG OLDER EUROPEANS: EVIDENCE FROM THE SURVEY OF HEALTH, AGEING, AND RETIREMENT IN EUROPE	530
04-2016	Peter Spahn	POPULATION GROWTH, SAVING, INTEREST RATES AND STAGNATION. DISCUSSING THE EGGERTSSON- MEHROTRA-MODEL	520
05-2016	Vincent Dekker, Kristina Strohmaier, Nicole Bosch	A DATA-DRIVEN PROCEDURE TO DETERMINE THE BUNCHING WINDOW – AN APPLICATION TO THE NETHERLANDS	520
06-2016	Philipp Baudy, Dario Cords	DEREGULATION OF TEMPORARY AGENCY EMPLOYMENT IN A UNIONIZED ECONOMY: DOES THIS REALLY LEAD TO A SUBSTITUTION OF REGULAR EMPLOYMENT?	520

No.	Author	Title	Inst
07-2016	Robin Jessen, Davud Rostam-Afschar, Sebastian Schmitz	HOW IMPORTANT IS PRECAUTIONARY LABOR SUPPLY?	520
08-2016	Peng Nie, Alfonso Sousa-Poza, Jianhong Xue	FUEL FOR LIFE: DOMESTIC COOKING FUELS AND WOMEN'S HEALTH IN RURAL CHINA	530
09-2016	Bogang Jun, Seung Kyu-Yi, Tobias Buchmann, Matthias Müller	THE CO-EVOLUTION OF INNOVATION NETWORKS: COLLABORATION BETWEEN WEST AND EAST GERMANY FROM 1972 TO 2014	520
10-2016	Vladan Ivanovic, Vadim Kufenko, Boris Begovic Nenad Stanistic, Vincent Geloso	CONTINUITY UNDER A DIFFERENT NAME. THE OUTCOME OF PRIVATISATION IN SERBIA	520
11-2016	David E. Bloom Michael Kuhn Klaus Prettnner	THE CONTRIBUTION OF FEMALE HEALTH TO ECONOMIC DEVELOPMENT	520
12-2016	Franz X. Hof Klaus Prettnner	THE QUEST FOR STATUS AND R&D-BASED GROWTH	520
13-2016	Jung-In Yeon Andreas Pyka Tai-Yoo Kim	STRUCTURAL SHIFT AND INCREASING VARIETY IN KOREA, 1960–2010: EMPIRICAL EVIDENCE OF THE ECONOMIC DEVELOPMENT MODEL BY THE CREATION OF NEW SECTORS	520
14-2016	Benjamin Fuchs	THE EFFECT OF TEENAGE EMPLOYMENT ON CHARACTER SKILLS, EXPECTATIONS AND OCCUPATIONAL CHOICE STRATEGIES	520
15-2016	Seung-Kyu Yi Bogang Jun	HAS THE GERMAN REUNIFICATION STRENGTHENED GERMANY'S NATIONAL INNOVATION SYSTEM? TRIPLE HELIX DYNAMICS OF GERMANY'S INNOVATION SYSTEM	520
16-2016	Gregor Pfeifer Fabian Wahl Martyrna Marczyk	ILLUMINATING THE WORLD CUP EFFECT: NIGHT LIGHTS EVIDENCE FROM SOUTH AFRICA	520
17-2016	Malte Klein Andreas Sauer	CELEBRATING 30 YEARS OF INNOVATION SYSTEM RESEARCH: WHAT YOU NEED TO KNOW ABOUT INNOVATION SYSTEMS	570
18-2016	Klaus Prettnner	THE IMPLICATIONS OF AUTOMATION FOR ECONOMIC GROWTH AND THE LABOR SHARE	520
19-2016	Klaus Prettnner Andreas Schaefer	HIGHER EDUCATION AND THE FALL AND RISE OF INEQUALITY	520
20-2016	Vadim Kufenko Klaus Prettnner	YOU CAN'T ALWAYS GET WHAT YOU WANT? ESTIMATOR CHOICE AND THE SPEED OF CONVERGENCE	520

No.	Author	Title	Inst
01-2017	Annarita Baldanzi Alberto Bucci Klaus Prettner	CHILDRENS HEALTH, HUMAN CAPITAL ACCUMULATION, AND R&D-BASED ECONOMIC GROWTH	INEPA
02-2017	Julius Tennert Marie Lambert Hans-Peter Burghof	MORAL HAZARD IN VC-FINANCE: MORE EXPENSIVE THAN YOU THOUGHT	INEF
03-2017	Michael Ahlheim Oliver Frör Nguyen Minh Duc Antonia Rehl Ute Siepmann Pham Van Dinh	LABOUR AS A UTILITY MEASURE RECONSIDERED	520
04-2017	Bohdan Kukharsky Sebastian Seiffert	GUN VIOLENCE IN THE U.S.: CORRELATES AND CAUSES	520
05-2017	Ana Abeliansky Klaus Prettner	AUTOMATION AND DEMOGRAPHIC CHANGE	520
06-2017	Vincent Geloso Vadim Kufenko	INEQUALITY AND GUARD LABOR, OR PROHIBITION AND GUARD LABOR?	INEPA
07-2017	Emanuel Gasteiger Klaus Prettner	ON THE POSSIBILITY OF AUTOMATION-INDUCED STAGNATION	520
08-2017	Klaus Prettner Holger Strulik	THE LOST RACE AGAINST THE MACHINE: AUTOMATION, EDUCATION, AND INEQUALITY IN AN R&D-BASED GROWTH MODEL	INEPA
09-2017	David E. Bloom Simiao Chen Michael Kuhn Mark E. McGovern Les Oxley Klaus Prettner	THE ECONOMIC BURDEN OF CHRONIC DISEASES: ESTIMATES AND PROJECTIONS FOR CHINA, JAPAN, AND SOUTH KOREA	520
10-2017	Sebastian Till Braun Nadja Dwenger	THE LOCAL ENVIRONMENT SHAPES REFUGEE INTEGRATION: EVIDENCE FROM POST-WAR GERMANY	INEPA
11-2017	Vadim Kufenko Klaus Prettner Vincent Geloso	DIVERGENCE, CONVERGENCE, AND THE HISTORY-AUGMENTED SOLOW MODEL	INEPA
12-2017	Frank M. Fossen Ray Rees Davud Rostam-Afschar Viktor Steiner	HOW DO ENTREPRENEURIAL PORTFOLIOS RESPOND TO INCOME TAXATION?	520
13-2017	Steffen Otterbach Michael Rogan	SPATIAL DIFFERENCES IN STUNTING AND HOUSEHOLD AGRICULTURAL PRODUCTION IN SOUTH AFRICA: (RE-) EXAMINING THE LINKS USING NATIONAL PANEL SURVEY DATA	INEPA

FZID Discussion Papers

(published 2009-2014)

Competence Centers

IK	Innovation and Knowledge
ICT	Information Systems and Communication Systems
CRFM	Corporate Finance and Risk Management
HCM	Health Care Management
CM	Communication Management
MM	Marketing Management
ECO	Economics

Download FZID Discussion Papers from our homepage: https://wiso.uni-hohenheim.de/archiv_fzid_papers

Nr.	Autor	Titel	CC
01-2009	Julian P. Christ	NEW ECONOMIC GEOGRAPHY RELOADED: Localized Knowledge Spillovers and the Geography of Innovation	IK
02-2009	André P. Slowak	MARKET FIELD STRUCTURE & DYNAMICS IN INDUSTRIAL AUTOMATION	IK
03-2009	Pier Paolo Saviotti, Andreas Pyka	GENERALIZED BARRIERS TO ENTRY AND ECONOMIC DEVELOPMENT	IK
04-2009	Uwe Focht, Andreas Richter and Jörg Schiller	INTERMEDIATION AND MATCHING IN INSURANCE MARKETS	HCM
05-2009	Julian P. Christ, André P. Slowak	WHY BLU-RAY VS. HD-DVD IS NOT VHS VS. BETAMAX: THE CO-EVOLUTION OF STANDARD-SETTING CONSORTIA	IK
06-2009	Gabriel Felbermayr, Mario Larch and Wolfgang Lechthaler	UNEMPLOYMENT IN AN INTERDEPENDENT WORLD	ECO
07-2009	Steffen Otterbach	MISMATCHES BETWEEN ACTUAL AND PREFERRED WORK TIME: Empirical Evidence of Hours Constraints in 21 Countries	HCM
08-2009	Sven Wydra	PRODUCTION AND EMPLOYMENT IMPACTS OF NEW TECHNOLOGIES – ANALYSIS FOR BIOTECHNOLOGY	IK
09-2009	Ralf Richter, Jochen Streb	CATCHING-UP AND FALLING BEHIND KNOWLEDGE SPILLOVER FROM AMERICAN TO GERMAN MACHINE TOOL MAKERS	IK

Nr.	Autor	Titel	CC
10-2010	Rahel Aichele, Gabriel Felbermayr	KYOTO AND THE CARBON CONTENT OF TRADE	ECO
11-2010	David E. Bloom, Alfonso Sousa-Poza	ECONOMIC CONSEQUENCES OF LOW FERTILITY IN EUROPE	HCM
12-2010	Michael Ahlheim, Oliver Frör	DRINKING AND PROTECTING – A MARKET APPROACH TO THE PRESERVATION OF CORK OAK LANDSCAPES	ECO
13-2010	Michael Ahlheim, Oliver Frör, Antonia Heinke, Nguyen Minh Duc, and Pham Van Dinh	LABOUR AS A UTILITY MEASURE IN CONTINGENT VALUATION STUDIES – HOW GOOD IS IT REALLY?	ECO
14-2010	Julian P. Christ	THE GEOGRAPHY AND CO-LOCATION OF EUROPEAN TECHNOLOGY-SPECIFIC CO-INVENTORSHIP NETWORKS	IK
15-2010	Harald Degner	WINDOWS OF TECHNOLOGICAL OPPORTUNITY DO TECHNOLOGICAL BOOMS INFLUENCE THE RELATIONSHIP BETWEEN FIRM SIZE AND INNOVATIVENESS?	IK
16-2010	Tobias A. Jopp	THE WELFARE STATE EVOLVES: GERMAN KNAPPSCHAFTEN, 1854-1923	HCM
17-2010	Stefan Kirn (Ed.)	PROCESS OF CHANGE IN ORGANISATIONS THROUGH eHEALTH	ICT
18-2010	Jörg Schiller	ÖKONOMISCHE ASPEKTE DER ENTLOHNUNG UND REGULIERUNG UNABHÄNGIGER VERSICHERUNGSVERMITTLER	HCM
19-2010	Frauke Lammers, Jörg Schiller	CONTRACT DESIGN AND INSURANCE FRAUD: AN EXPERIMENTAL INVESTIGATION	HCM
20-2010	Martyna Marczak, Thomas Beissinger	REAL WAGES AND THE BUSINESS CYCLE IN GERMANY	ECO
21-2010	Harald Degner, Jochen Streb	FOREIGN PATENTING IN GERMANY, 1877-1932	IK
22-2010	Heiko Stüber, Thomas Beissinger	DOES DOWNWARD NOMINAL WAGE RIGIDITY DAMPEN WAGE INCREASES?	ECO
23-2010	Mark Spoerer, Jochen Streb	GUNS AND BUTTER – BUT NO MARGARINE: THE IMPACT OF NAZI ECONOMIC POLICIES ON GERMAN FOOD CONSUMPTION, 1933-38	ECO

Nr.	Autor	Titel	CC
24-2011	Dhammika Dharmapala, Nadine Riedel	EARNINGS SHOCKS AND TAX-MOTIVATED INCOME-SHIFTING: EVIDENCE FROM EUROPEAN MULTINATIONALS	ECO
25-2011	Michael Schuele, Stefan Kirn	QUALITATIVES, RÄUMLICHES SCHLIEßEN ZUR KOLLISIONSERKENNUNG UND KOLLISIONSVERMEIDUNG AUTONOMER BDI-AGENTEN	ICT
26-2011	Marcus Müller, Guillaume Stern, Ansgar Jacob and Stefan Kirn	VERHALTENSMODELLE FÜR SOFTWAREAGENTEN IM PUBLIC GOODS GAME	ICT
27-2011	Monnet Benoit, Patrick Gbakoua and Alfonso Sousa-Poza	ENGEL CURVES, SPATIAL VARIATION IN PRICES AND DEMAND FOR COMMODITIES IN CÔTE D'IVOIRE	ECO
28-2011	Nadine Riedel, Hannah Schildberg- Hörisch	ASYMMETRIC OBLIGATIONS	ECO
29-2011	Nicole Waidlein	CAUSES OF PERSISTENT PRODUCTIVITY DIFFERENCES IN THE WEST GERMAN STATES IN THE PERIOD FROM 1950 TO 1990	IK
30-2011	Dominik Hartmann, Atilio Arata	MEASURING SOCIAL CAPITAL AND INNOVATION IN POOR AGRICULTURAL COMMUNITIES. THE CASE OF CHÁPARRA - PERU	IK
31-2011	Peter Spahn	DIE WÄHRUNGSKRISEUNION DIE EURO-VERSCHULDUNG DER NATIONALSTAATEN ALS SCHWACHSTELLE DER EWU	ECO
32-2011	Fabian Wahl	DIE ENTWICKLUNG DES LEBENSSTANDARDS IM DRITTEN REICH – EINE GLÜCKSÖKONOMISCHE PERSPEKTIVE	ECO
33-2011	Giorgio Triulzi, Ramon Scholz and Andreas Pyka	R&D AND KNOWLEDGE DYNAMICS IN UNIVERSITY-INDUSTRY RELATIONSHIPS IN BIOTECH AND PHARMACEUTICALS: AN AGENT-BASED MODEL	IK
34-2011	Claus D. Müller- Hengstenberg, Stefan Kirn	ANWENDUNG DES ÖFFENTLICHEN VERGABERECHTS AUF MODERNE IT SOFTWAREENTWICKLUNGSVERFAHREN	ICT
35-2011	Andreas Pyka	AVOIDING EVOLUTIONARY INEFFICIENCIES IN INNOVATION NETWORKS	IK
36-2011	David Bell, Steffen Otterbach and Alfonso Sousa-Poza	WORK HOURS CONSTRAINTS AND HEALTH	HCM
37-2011	Lukas Scheffknecht, Felix Geiger	A BEHAVIORAL MACROECONOMIC MODEL WITH ENDOGENOUS BOOM-BUST CYCLES AND LEVERAGE DYNAMICS	ECO
38-2011	Yin Krogmann, Ulrich Schwalbe	INTER-FIRM R&D NETWORKS IN THE GLOBAL PHARMACEUTICAL BIOTECHNOLOGY INDUSTRY DURING 1985–1998: A CONCEPTUAL AND EMPIRICAL ANALYSIS	IK

Nr.	Autor	Titel	CC
39-2011	Michael Ahlheim, Tobias Börger and Oliver Frör	RESPONDENT INCENTIVES IN CONTINGENT VALUATION: THE ROLE OF RECIPROCITY	ECO
40-2011	Tobias Börger	A DIRECT TEST OF SOCIALLY DESIRABLE RESPONDING IN CONTINGENT VALUATION INTERVIEWS	ECO
41-2011	Ralf Rukwid, Julian P. Christ	QUANTITATIVE CLUSTERIDENTIFIKATION AUF EBENE DER DEUTSCHEN STADT- UND LANDKREISE (1999-2008)	IK

Nr.	Autor	Titel	CC
42-2012	Benjamin Schön, Andreas Pyka	A TAXONOMY OF INNOVATION NETWORKS	IK
43-2012	Dirk Foremny, Nadine Riedel	BUSINESS TAXES AND THE ELECTORAL CYCLE	ECO
44-2012	Gisela Di Meglio, Andreas Pyka and Luis Rubalcaba	VARIETIES OF SERVICE ECONOMIES IN EUROPE	IK
45-2012	Ralf Rukwid, Julian P. Christ	INNOVATIONSPOTENTIALE IN BADEN-WÜRTTEMBERG: PRODUKTIONSCLUSTER IM BEREICH „METALL, ELEKTRO, IKT“ UND REGIONALE VERFÜGBARKEIT AKADEMISCHER FACHKRÄFTE IN DEN MINT-FÄCHERN	IK
46-2012	Julian P. Christ, Ralf Rukwid	INNOVATIONSPOTENTIALE IN BADEN-WÜRTTEMBERG: BRANCHENSPEZIFISCHE FORSCHUNGS- UND ENTWICKLUNGSAKTIVITÄT, REGIONALES PATENTAUFKOMMEN UND BESCHÄFTIGUNGSSTRUKTUR	IK
47-2012	Oliver Sauter	ASSESSING UNCERTAINTY IN EUROPE AND THE US - IS THERE A COMMON FACTOR?	ECO
48-2012	Dominik Hartmann	SEN MEETS SCHUMPETER. INTRODUCING STRUCTURAL AND DYNAMIC ELEMENTS INTO THE HUMAN CAPABILITY APPROACH	IK
49-2012	Harold Paredes- Frigolett, Andreas Pyka	DISTAL EMBEDDING AS A TECHNOLOGY INNOVATION NETWORK FORMATION STRATEGY	IK
50-2012	Martyna Marczyk, Víctor Gómez	CYCLICALITY OF REAL WAGES IN THE USA AND GERMANY: NEW INSIGHTS FROM WAVELET ANALYSIS	ECO
51-2012	André P. Slowak	DIE DURCHSETZUNG VON SCHNITTSTELLEN IN DER STANDARDSETZUNG: FALLBEISPIEL LADESYSTEM ELEKTROMOBILITÄT	IK
52-2012	Fabian Wahl	WHY IT MATTERS WHAT PEOPLE THINK - BELIEFS, LEGAL ORIGINS AND THE DEEP ROOTS OF TRUST	ECO
53-2012	Dominik Hartmann, Micha Kaiser	STATISTISCHER ÜBERBLICK DER TÜRKISCHEN MIGRATION IN BADEN-WÜRTTEMBERG UND DEUTSCHLAND	IK
54-2012	Dominik Hartmann, Andreas Pyka, Seda Aydin, Lena Klauß, Fabian Stahl, Ali Santircioglu, Silvia Oberegelsbacher, Sheida Rashidi, Gaye Onan and Suna Erginkoç	IDENTIFIZIERUNG UND ANALYSE DEUTSCH-TÜRKISCHER INNOVATIONSNETZWERKE. ERSTE ERGEBNISSE DES TGIN- PROJEKTES	IK
55-2012	Michael Ahlheim, Tobias Börger and Oliver Frör	THE ECOLOGICAL PRICE OF GETTING RICH IN A GREEN DESERT: A CONTINGENT VALUATION STUDY IN RURAL SOUTHWEST CHINA	ECO

Nr.	Autor	Titel	CC
56-2012	Matthias Strifler Thomas Beissinger	FAIRNESS CONSIDERATIONS IN LABOR UNION WAGE SETTING – A THEORETICAL ANALYSIS	ECO
57-2012	Peter Spahn	INTEGRATION DURCH WÄHRUNGSUNION? DER FALL DER EURO-ZONE	ECO
58-2012	Sibylle H. Lehmann	TAKING FIRMS TO THE STOCK MARKET: IPOS AND THE IMPORTANCE OF LARGE BANKS IN IMPERIAL GERMANY 1896-1913	ECO
59-2012	Sibylle H. Lehmann, Philipp Hauber and Alexander Opitz	POLITICAL RIGHTS, TAXATION, AND FIRM VALUATION – EVIDENCE FROM SAXONY AROUND 1900	ECO
60-2012	Martyna Marczak, Víctor Gómez	SPECTRAN, A SET OF MATLAB PROGRAMS FOR SPECTRAL ANALYSIS	ECO
61-2012	Theresa Lohse, Nadine Riedel	THE IMPACT OF TRANSFER PRICING REGULATIONS ON PROFIT SHIFTING WITHIN EUROPEAN MULTINATIONALS	ECO

Nr.	Autor	Titel	CC
62-2013	Heiko Stüber	REAL WAGE CYCLICALITY OF NEWLY HIRED WORKERS	ECO
63-2013	David E. Bloom, Alfonso Sousa-Poza	AGEING AND PRODUCTIVITY	HCM
64-2013	Martyna Marczak, V́ctor G3mez	MONTHLY US BUSINESS CYCLE INDICATORS: A NEW MULTIVARIATE APPROACH BASED ON A BAND-PASS FILTER	ECO
65-2013	Dominik Hartmann, Andreas Pyka	INNOVATION, ECONOMIC DIVERSIFICATION AND HUMAN DEVELOPMENT	IK
66-2013	Christof Ernst, Katharina Richter and Nadine Riedel	CORPORATE TAXATION AND THE QUALITY OF RESEARCH AND DEVELOPMENT	ECO
67-2013	Michael Ahlheim, Oliver Fr3r, Jiang Tong, Luo Jing and Sonna Pelz	NONUSE VALUES OF CLIMATE POLICY - AN EMPIRICAL STUDY IN XINJIANG AND BEIJING	ECO
68-2013	Michael Ahlheim, Friedrich Schneider	CONSIDERING HOUSEHOLD SIZE IN CONTINGENT VALUATION STUDIES	ECO
69-2013	Fabio Bertoni, Tereza Tykvov3	WHICH FORM OF VENTURE CAPITAL IS MOST SUPPORTIVE OF INNOVATION? EVIDENCE FROM EUROPEAN BIOTECHNOLOGY COMPANIES	CFRM
70-2013	Tobias Buchmann, Andreas Pyka	THE EVOLUTION OF INNOVATION NETWORKS: THE CASE OF A GERMAN AUTOMOTIVE NETWORK	IK
71-2013	B. Vermeulen, A. Pyka, J. A. La Poutr3 and A. G. de Kok	CAPABILITY-BASED GOVERNANCE PATTERNS OVER THE PRODUCT LIFE-CYCLE	IK
72-2013	Beatriz Fabiola L3pez Ulloa, Valerie M3ller and Alfonso Sousa- Poza	HOW DOES SUBJECTIVE WELL-BEING EVOLVE WITH AGE? A LITERATURE REVIEW	HCM
73-2013	Wencke Gwozdz, Alfonso Sousa-Poza, Lucia A. Reisch, Wolfgang Ahrens, Stefaan De Henauw, Gabriele Eiben, Juan M. Fern3ndez-Alvira, Charalampos Hadjigeorgiou, Eva Kov3cs, Fabio Lauria, Toomas Veidebaum, Garrath Williams, Karin Bammann	MATERNAL EMPLOYMENT AND CHILDHOOD OBESITY – A EUROPEAN PERSPECTIVE	HCM

Nr.	Autor	Titel	CC
74-2013	Andreas Haas, Annette Hofmann	RISIKEN AUS CLOUD-COMPUTING-SERVICES: FRAGEN DES RISIKOMANAGEMENTS UND ASPEKTE DER VERSICHERBARKEIT	HCM
75-2013	Yin Krogmann, Nadine Riedel and Ulrich Schwalbe	INTER-FIRM R&D NETWORKS IN PHARMACEUTICAL BIOTECHNOLOGY: WHAT DETERMINES FIRM'S CENTRALITY-BASED PARTNERING CAPABILITY?	ECO, IK
76-2013	Peter Spahn	MACROECONOMIC STABILISATION AND BANK LENDING: A SIMPLE WORKHORSE MODEL	ECO
77-2013	Sheida Rashidi, Andreas Pyka	MIGRATION AND INNOVATION – A SURVEY	IK
78-2013	Benjamin Schön, Andreas Pyka	THE SUCCESS FACTORS OF TECHNOLOGY-SOURCING THROUGH MERGERS & ACQUISITIONS – AN INTUITIVE META- ANALYSIS	IK
79-2013	Irene Prostoplow, Andreas Pyka and Barbara Heller-Schuh	TURKISH-GERMAN INNOVATION NETWORKS IN THE EUROPEAN RESEARCH LANDSCAPE	IK
80-2013	Eva Schlenker, Kai D. Schmid	CAPITAL INCOME SHARES AND INCOME INEQUALITY IN THE EUROPEAN UNION	ECO
81-2013	Michael Ahlheim, Tobias Börger and Oliver Frör	THE INFLUENCE OF ETHNICITY AND CULTURE ON THE VALUATION OF ENVIRONMENTAL IMPROVEMENTS – RESULTS FROM A CVM STUDY IN SOUTHWEST CHINA –	ECO
82-2013	Fabian Wahl	DOES MEDIEVAL TRADE STILL MATTER? HISTORICAL TRADE CENTERS, AGGLOMERATION AND CONTEMPORARY ECONOMIC DEVELOPMENT	ECO
83-2013	Peter Spahn	SUBPRIME AND EURO CRISIS: SHOULD WE BLAME THE ECONOMISTS?	ECO
84-2013	Daniel Guffarth, Michael J. Barber	THE EUROPEAN AEROSPACE R&D COLLABORATION NETWORK	IK
85-2013	Athanasios Saitis	KARTELLBEKÄMPFUNG UND INTERNE KARTELLSTRUKTUREN: EIN NETZWERKTHEORETISCHER ANSATZ	IK

Nr.	Autor	Titel	CC
86-2014	Stefan Kirn, Claus D. Müller-Hengstenberg	INTELLIGENTE (SOFTWARE-)AGENTEN: EINE NEUE HERAUSFORDERUNG FÜR DIE GESELLSCHAFT UND UNSER RECHTSSYSTEM?	ICT
87-2014	Peng Nie, Alfonso Sousa-Poza	MATERNAL EMPLOYMENT AND CHILDHOOD OBESITY IN CHINA: EVIDENCE FROM THE CHINA HEALTH AND NUTRITION SURVEY	HCM
88-2014	Steffen Otterbach, Alfonso Sousa-Poza	JOB INSECURITY, EMPLOYABILITY, AND HEALTH: AN ANALYSIS FOR GERMANY ACROSS GENERATIONS	HCM
89-2014	Carsten Burhop, Sibylle H. Lehmann-Hasemeyer	THE GEOGRAPHY OF STOCK EXCHANGES IN IMPERIAL GERMANY	ECO
90-2014	Martyna Marczak, Tommaso Proietti	OUTLIER DETECTION IN STRUCTURAL TIME SERIES MODELS: THE INDICATOR SATURATION APPROACH	ECO
91-2014	Sophie Urmetzer, Andreas Pyka	VARIETIES OF KNOWLEDGE-BASED BIOECONOMIES	IK
92-2014	Bogang Jun, Joongho Lee	THE TRADEOFF BETWEEN FERTILITY AND EDUCATION: EVIDENCE FROM THE KOREAN DEVELOPMENT PATH	IK
93-2014	Bogang Jun, Tai-Yoo Kim	NON-FINANCIAL HURDLES FOR HUMAN CAPITAL ACCUMULATION: LANDOWNERSHIP IN KOREA UNDER JAPANESE RULE	IK
94-2014	Michael Ahlheim, Oliver Frör, Gerhard Langenberger and Sonna Pelz	CHINESE URBANITES AND THE PRESERVATION OF RARE SPECIES IN REMOTE PARTS OF THE COUNTRY – THE EXAMPLE OF EAGLEWOOD	ECO
95-2014	Harold Paredes-Frigolett, Andreas Pyka, Javier Pereira and Luiz Flávio Autran Monteiro Gomes	RANKING THE PERFORMANCE OF NATIONAL INNOVATION SYSTEMS IN THE IBERIAN PENINSULA AND LATIN AMERICA FROM A NEO-SCHUMPETERIAN ECONOMICS PERSPECTIVE	IK
96-2014	Daniel Guffarth, Michael J. Barber	NETWORK EVOLUTION, SUCCESS, AND REGIONAL DEVELOPMENT IN THE EUROPEAN AEROSPACE INDUSTRY	IK

IMPRINT

University of Hohenheim

Dean's Office of the Faculty of Business, Economics and Social Sciences

Palace Hohenheim 1 B

70593 Stuttgart | Germany

Fon +49 (0)711 459 22488

Fax +49 (0)711 459 22785

E-mail wiso@uni-hohenheim.de

Web www.wiso.uni-hohenheim.de