

Duarte, Pablo

**Working Paper**

## The relationship between GDP and the size of the informal economy: Empirical evidence for Spain

Working Paper, No. 127

**Provided in Cooperation with:**

University of Leipzig, Faculty of Economics and Management Science

*Suggested Citation:* Duarte, Pablo (2014) : The relationship between GDP and the size of the informal economy: Empirical evidence for Spain, Working Paper, No. 127, Universität Leipzig, Wirtschaftswissenschaftliche Fakultät, Leipzig

This Version is available at:

<https://hdl.handle.net/10419/93062>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

Working Paper, No. 127

Pablo Duarte

**The Relationship between GDP and the  
Size of the Informal Economy: Empirical  
Evidence for Spain**

Februar 2014

# The Relationship between GDP and the Size of the Informal Economy: Empirical Evidence for Spain

Pablo Duarte\*

## Abstract

The empirical evidence on the linkage of the informal economy and GDP is ambiguous. It depends on the method used to estimate the size of the informal economy. I propose a common factor of four different approximations of the size of the informal economy as an alternative. Using Spain as an example I find that GDP Granger-causes informality, but not the other way around. I also find that positive GDP shocks induce positive and statistically significant responses of the size of the informal economy.

*Keywords:* Informal economy, dynamic factor model

*JEL:* C38, O17

---

\*Institute for Economic Policy; University of Leipzig; Grimmaische Str. 12; 04109 – Leipzig; Germany; Email: pablo.duarte@uni-leipzig.de.

## 1 Introduction

Informal markets exist all over the world and have motivated different studies on its size, its determinants and its effects on other relevant economic variables for developing and OECD countries.<sup>1</sup> One main discussion point has been the relationship between GDP and the size of the informal economy. Does a higher GDP encourage or discourage informal activities? Do larger informal markets boost or hinder growth? Using Spain as an example and the four most recent approaches to estimate the size of the informal economy, I show in a VAR-framework that the different informality estimation methods lead to contradictory evidence on the relationship between GDP and informality. I propose a common factor of the four informality estimates as an alternative.

Markets are institutionally secured arenas in which voluntary exchange takes place (Vanberg, 2001). Informal (shadow, hidden, underground, black, unofficial) markets are *illegal* institutionally secured arenas where voluntary exchange of *legal* goods and services takes place.<sup>2</sup> Porta and Shleifer (2008) recognize three different views on informality. First, a legal-institutional perspective (or “romantic view”), that sees informal markets as the best response to legal exclusion and unequal enforcement of property rights (De Soto, 1989, 2000). Informality is therefore a symptom of “bad” or unequal law. Second, a tax-avoidance view (or “parasite view”) which considers informal firms as harmful for growth as they are small and unproductive and take an important market share away from the more productive formal firms (Farrell, 2004). Third, a “dual view”, which considers formal and informal markets to be independent from each other, as their producers and consumers operate in completely different scenarios. From the dual perspective, informal markets are exchange arenas mainly for poor people and tend to disappear with economic development (Porta and Shleifer, 2008, 278).

Except for the legal-institutional perspective, the different perspectives on informality imply a specific macroeconomic relationship between GDP and informal production. The tax-evasion view implies a negative relationship. An increase in informal production, for example through informal investment

---

<sup>1</sup>See for example De Soto (2000), Schneider (2005), Schneider *et al.* (2010) and Elgin and Oztunali (2012) for a worldwide analysis, Bajada and Schneider (2005) for the Asia-Pacific, De Soto (1989) Loayza (1996) and Perry *et al.* (2007) for Latin America, Eilat and Zinnes (2002) and Feige and Urban (2008) for transition countries, and Bovi and Dell’Anno (2010) and Feld and Schneider (2010) for OECD countries.

<sup>2</sup>For a discussion on the most used definitions of informality in economics see Schneider and Enste (2000).

made possible by higher remittances, would have a negative effect on formal GDP, as unproductive competition increases, forgone tax revenues increase and potential government expenditure decreases. In the other direction, an increase in GDP, for example through a tax reduction, would increase the expected benefits from formality, such that participants of informal markets might decide to become formal. Informal production and income would therefore decrease. The dual view implies that GDP and informal production are completely independent, that is that one variable does not respond to shocks of the other.

If the relationship between GDP and informal production is not as assumed by each view, the effects of the policy implications might be counterproductive. The tax-evasion perspective, for example, mainly recommends a stronger enforcement of tax collection and “combating” informality more efficiently. But if formal and informal production are not negatively but positively interlinked, “combating” informality would be harmful for the formal economy. On the other hand, expansive monetary or fiscal policy aiming to impulse the production of the formal sector, would also increase informal production and thus unproductive competition. Such dilemma reflects the importance of empirical evidence on the relationship between formal and informal markets.

The empirical evidence on the relationship between GDP and informality depends heavily on the method used to estimate the size of the informal economy and is contradictory<sup>3</sup> and difficult to compare. The main studies examine different countries and use only one, each time different, informality estimation approach. The results do not point into the same direction. For instance, Giles (1997) and Giles *et al.* (2002) use the multiple-indicators multiple-causes (MIMIC) approach for New Zealand and Canada and suggest evidence of Granger-causality from GDP to informality and mild evidence in the opposite direction. Bovi (2004) uses official data from the Italian statistical office and claims that both variables are independent. Serrano Sanz and Gadea (2005) use the monetary approach for Spain and suggest a positive Granger-causality in both directions. In a Panel-VAR framework, Birinci (2013) uses a model approach for 12 advanced economies and reports a positive effect of the size of the informal sector on GDP growth but not the other way around. To my best knowledge, there is no work examining the relationship between GDP and the informal economy in a VAR-framework for one country

---

<sup>3</sup>See Dell’Anno (2008) for a summary of the contradictory empirical evidence on the determinants of informality.

by using different informality estimation methods.

I test the relationship between GDP growth and the first log-differences of four different informality estimations using data for Spain. The evidence is contradictory. The four informality estimations seem to capture different information, even though they aim at the same unobserved variable. Assuming that each informality time series can be expressed as the sum of the true informality size – which is a *common factor* for all estimations – and some “noise” – the proper characteristics of each series – I estimate a dynamic factor model to compute a new informality time series. I examine the relationship between the common factor and GDP growth. I find that GDP growth Granger-causes informality, but not the other way around, and that positive GDP growth shocks induce significantly positive responses in the size of the informal economy, but not vice-versa. The empirical evidence suggests that, everything else equal, expansionary policies will likely induce a higher informal income and that a bigger informal economy will not have the negative effect on GDP alleged by the tax-evasion view. Policies seeking to “combat” informality will neither dampen nor boost formal economic growth.

The remainder of the paper is organized as follows: section two describes the four most commonly used methods to estimate the informal economy. Section three examines the causal relationships between each one of the estimates of the informal economy and Spanish GDP. Section four calculates a common factor of the four informal market estimations and examines the relationship between the common factor and GDP. Section five draws conclusions regarding macroeconomic analysis based on the estimation of the size of the informal economy.

## 2 Measuring the informal economy

Direct and indirect methods haven been widely used to estimate the size of the informal economy.<sup>4</sup> The direct methods are microeconomic approaches based on surveys.<sup>5</sup> The indirect methods are more appropriate to examine macroeconomic relationships as the one between GDP and the informal economy, because they are available for a longer period of time and in a regular frequency. Therefore, I focus on the four most recently used methods of estimating the size of the informal economy: the currency demand

---

<sup>4</sup>See (Schneider and Bühn, 2013) and (Schneider and Enste, 2000, p. 91 - 99) for a comprehensive and critical overview of the methods for estimating the size of the informal economy.

<sup>5</sup>Martinez-Lopez (2012), for example, presents a recent study for Spain.

approach, the energy consumption approach, the MIMIC approach, and the model based approach.

#### *The currency demand approach*

Under this approach it is assumed that informal transactions are mainly done in cash to prevent being traced by the authorities. Using the currency method, a currency demand equation over time is estimated using conventional explanatory variables including a tax variable. Two currency demand values are estimated for each year: one assuming the tax variable is zero (no evasion is necessary) and one with the real values of the tax variable. The difference between the two estimated cash demand values is the *tax induced currency demand* and thus the *illegal money*. The informal production can be estimated assuming that the velocity of money is equal in both the formal and informal economies (Tanzi, 1983).

The currency demand approach, however, has relevant shortcomings. First, not all informal transactions are done in cash. Second, the tax burden is not the only motivation for informal activity. Third, the assumptions of equal velocity of money at the formal and informal sectors as well as the tax burden of zero at the benchmark year tend to underestimate the size of the informal sector (Schneider and Bühn, 2013, 14).

#### *The energy consumption approach*

The energy consumption method was introduced by Kaufmann and Kaliberda (1996) and Lackó (2000). Considering that energy consumption is an essential input for production, the method assumes that the elasticity of electricity consumption to GDP equals one. Under these assumptions and taking energy consumption as a proxy for the “true” national production it is possible to estimate the size of the informal economy based on an energy demand function of the households and the growth rates of official GDP.

The energy consumption approach can be criticized on different points. The intensity of electricity usage depends on the kind of activity and therefore changes in the size of the informal economy can be over or underestimated. The elasticity of electricity consumption to GDP is not necessarily equal to one and technological improvement may change the energy consumption patterns in both the formal and the informal sectors (Schneider and Bühn, 2013, 16).

### *The MIMIC approach*

The multiple-indicators multiple-causes (MIMIC) approach considers the size of the informal economy as an unobserved (latent) variable which is related to variables that *indicate* its changes and others which reflect its *causes*. The *indicators* and *causes* are selected based on theoretical considerations and the estimation is done in a factor-analysis framework (Schneider, 2005).

The MIMIC approach is based on more than only one indicator for the estimation of the size of the informal economy. Its main weaknesses have to do with the estimated latent variable. The calculated factor can not be interpreted exclusively as the size of the informal economy and it is plausible that it includes additional components which are related to the indicators and causes but not necessarily to the informal economy (Schneider and Bühn, 2013, 24). As the estimation procedure does not provide the size of the informal sector directly but only a set of estimated coefficients, an initial value is necessary to “calibrate” the model. The calibration is mainly done by using data estimated by the currency demand method for one period, transporting its biases to the MIMIC-estimated series (Breusch, 2005).

### *The model based approach*

The model estimation approach was introduced by Elgin and Oztunali (2012). The method relies on a two-sector dynamic general equilibrium model in which infinitely-lived representative households may choose between a formal and an informal production technology. After calibrating the model, Elgin and Oztunali (2012) estimate the size of the informal economy for 161 countries from 1950 to 2009.

Elgin and Oztunali (2012) claim that the model approach has the advantages of being micro-founded, of not relying on ad-hoc econometric specifications and of evading statistical errors. A disadvantage is the sensibility of the computed values to the set-up of the DGE-model and to the selection of crucial parameters as the depreciation rate and the participation rates of the inputs in the assumed production technologies of the formal and the informal sectors.<sup>6</sup>

---

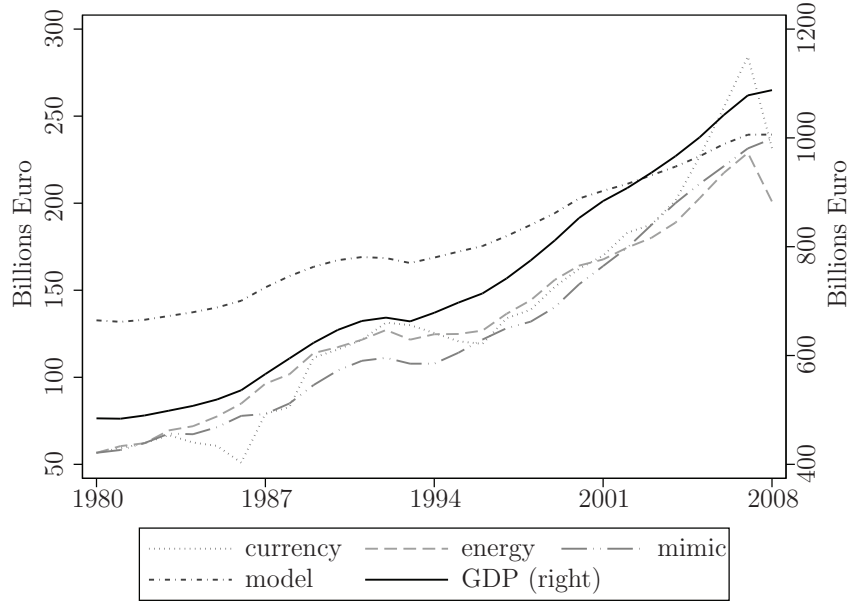
<sup>6</sup>The advantages and disadvantages of the model approach still need to be widely discussed.



### 3 The link between GDP and the informal economy

Figure 1 presents the annual time series of Spanish real GDP and the four estimations of the size of Spanish informal economy from 1980 to 2008 introduced above. The four series show a positive time trend and a reduction at the end. The difference between the highest and the lowest estimations reduces over time. In 1980, the size of the informal sector by the *model* approach is 27,4% of GDP and by the other three methods around 12% of GDP. In 2008 informality is 22% of GDP by the *model* approach and 18.5% by the *energy* approach.

Figure 1: Spanish Real GDP and Informal Economy



Note: The original data is provided as percentage of GDP. Source: Arrazola *et al.* (2011), Elgin and Oztunali (2012) and OECD Economic Outlook.

The estimations by the *currency*, *energy* and *MIMIC* approaches are reported by Arrazola *et al.* (2011). The estimation by the *model* method is from Elgin and Oztunali (2012). All five time series are I(1) and the null hypothesis of no-cointegration between each informality estimation and GDP can not be rejected such that there is no long-run equilibrating mechanism between each informality estimation and GDP. Therefore I use the first log-differences of each series.

I estimate four VAR models, one for each informality estimation ( $j$ ):

$$y_t = A_0 + A_1 y_{t-1} + \dots + A_p y_{t-p} + u_t$$

where  $y_t$  is a  $(2 \times 1)$  vector containing the variables  $\Delta GDP_t$  (the first log-difference of Spanish GDP) and  $\Delta I_t^j$  (the first log-difference of each  $j \in [1, 4]$  informality estimate).  $A_0$  is a  $(2 \times 1)$  matrix of intercepts,  $A_i$  are  $(2 \times 2)$  matrices of coefficients and  $u_t$  is a  $(2 \times 1)$  matrix of error terms. I select the optimal lag order  $p$  using the standard information criteria (AIC and BIC). The structures of the estimations are stable (the roots are inside the unit circle) and after testing the residuals for autocorrelation and normality, the models are well specified.

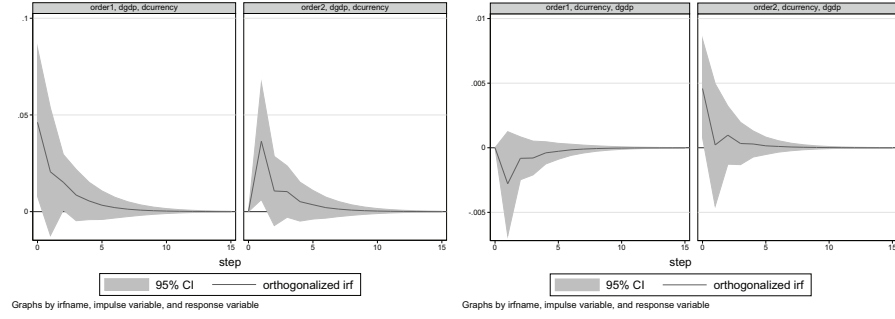
Table 1: Granger-Causality test:  $X$  does not Granger-cause  $Y$  (Wald-Test P-Values)

		Y				
		$\Delta GDP$	$\Delta currency$	$\Delta energy$	$\Delta MIMIC$	$\Delta model$
X	$\Delta GDP$		0.17	0.87	0.87	0.00
	$\Delta currency$	0.01				
	$\Delta energy$	0.70				
	$\Delta MIMIC$	0.00				
	$\Delta model$	0.00				

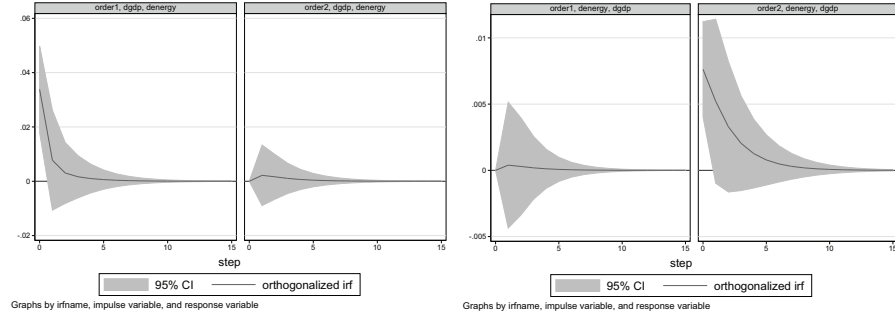
Table 1 shows the results of a Granger-causality test between GDP and informality in both directions. GDP improves the predictions of the size of the informal sector, only if it is estimated by the *model* method (first row, last column), but not if it is estimated by the *energy*, the *MIMIC* and the *currency* methods. In the opposite direction, the null hypothesis that informality does not Granger-cause GDP can be rejected with the *currency*, the *MIMIC* and the *model* methods but not with the *energy* method. Summing up, by the *currency* and the *MIMIC* methods, informality Granger-causes GDP, but not the other way around. Using the *energy* method, the variables are independent and the *model* approach suggests Granger-causality in both directions.

The impulse response functions in Figure 2 also show ambiguous evidence on the relationship between GDP and the size of the informal sector. The reactions to the shocks depend in most of the cases on the Cholesky ordering and their sign and statistical significance vary with the method used to estimate the size of the informal sector. With the *currency* (panel a) and *MIMIC* (panel c) methods, a positive GDP shock induces positive and (weak) statistically

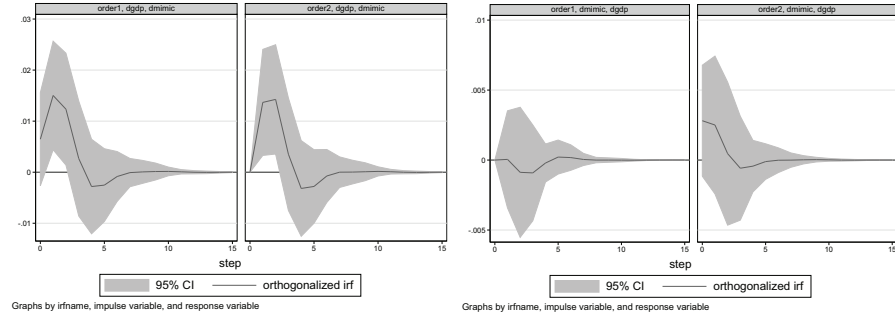
Figure 2: Impulse Response Functions: Spanish Real GDP and Informal Economy



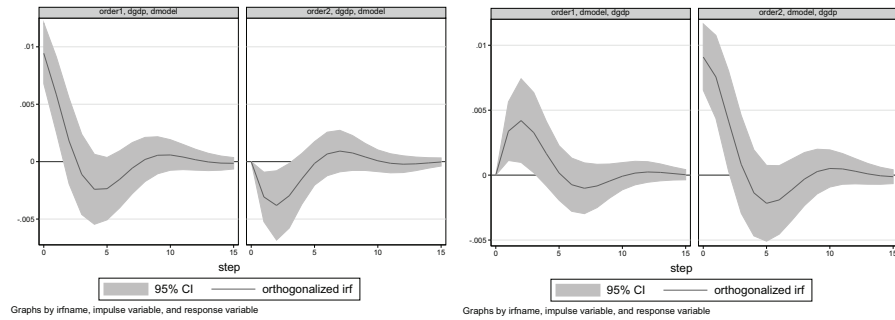
(a) Currency



(b) Energy



(c) MIMIC



(d) Model

Note: Order 1 and Order 2 are the alternative Cholesky orderings. The independent variable is GDP in Order 1 and each informality measure in Order 2.

significant responses of informality. A positive informality shock does not induce a statistically significant response of GDP. By the *energy* method (panel b), the variables' responses are positive and statistically significant if the impulse variable is first in the Cholesky ordering. By the *model* method (panel d), the reaction of GDP to an informality shock is positive and statistically significant if GDP is first in the Cholesky ordering and negative and (weak) statistically significant if informality is first in the Cholesky ordering. The reaction of informality to a GDP shock is positive and statistically significant irrespective of the Cholesky ordering.

The fact that the informality estimations reflect a different Granger-causality relationship to GDP and that the variables respond differently to the shocks shows that the information captured by each estimation method is substantially different, and that it has a decisive influence on the conclusions drawn from such tests.

#### 4 The informality common factor

Despite the contradictory results, all four informality estimations intend to approximate the same unobserved variable. Said differently, each informality estimation can be expressed as the sum of two components: the “true” unobserved variable  $f_t$ , which is common for all four estimations and an *idiosyncratic* component  $u_t$ , which stores the specific characteristics of each series. Such expression is the starting point of factor analysis models. In general, the model can be written as:

$$Z_t = \mathbf{L}f_t + u_t, \quad (1)$$

where  $Z_t$  is a  $(K \times 1)$  vector of variables,  $f_t$  a  $(N \times 1)$  vector of common factors and  $\mathbf{L}$  a  $(K \times N)$  vector of *factor loadings* with  $N < K$ . In this case,  $Z_t$  includes the four log-first-differences of the informality estimations  $\Delta I_t^j$  ( $K = 4$ ).  $N = 1$ , as I only estimate one common factor. Dynamic factor models (DFM), in contrast to strict factor models, allow for autocorrelation of the factors and the idiosyncratic components (Breitung and Eickmeier, 2006), such that the equations for the common factor  $f_t$  and the idiosyncratic component  $u_t$  can be specified as

$$f_t = A_1 f_{t-1} + \cdots A_p f_{t-p} + \eta_t \quad (2)$$

and

$$u_t = C_1 u_{t-1} + \cdots C_q u_{t-q} + \varepsilon_t, \quad (3)$$

where  $\eta_t$  and  $\varepsilon_t$  are white noise processes. The coefficients to be estimated are the factor loadings coefficient matrix  $\mathbf{L}$  and the matrices  $A_i$  and  $C_j$  for  $i = 1, \dots, p$  and  $j = 1, \dots, q$ .

DFMs are usually used for Now- and Forecasting variables that are reported with a certain delay (i.e. GDP) using variables which are known at the time of the prediction and available at higher frequencies.<sup>7</sup> In such cases it is possible to measure the performance of the estimations by comparing them with the true variable at the time it is released. For the size of the informal sector such a measure is not possible because the variable is not observable. Even though it can not be shown that a dynamic factor model performs better than other alternatives, its theoretical structure offers a helpful tool to go one step further in the estimation of the size of the informal economy.

Stock and Watson (2010) review three generations of different DFM estimation methods. The estimation procedure here corresponds to the first generation. The estimation comprises three steps. The first one is the computation of the Gaussian Likelihood using the Kalman Filter, the second is the estimation of the parameters of the matrices  $\mathbf{L}$ ,  $A_i$  and  $C_j$  and the last one is the utilization of the Kalman smoother to obtain estimations of the factor  $f_t$ .

Equation 1 contains the given information and is thus the observation equation. Equations 2 and 3 are the state equations. Following Stock and Watson (1991), the first step follows the prediction equations which can be written as:

$$\alpha_{t|t-1} = T_t \alpha_{t-1|t-1}, \quad (4)$$

where  $\alpha_{t|\tau}$  represents the estimate of the vector of states ( $f_t$  and  $u_t$ ) according to the available information of the vector  $Z_t$  until the last period  $\tau$ , and

$$P_{t|t-1} = T_t P_{t-1|t-1} T' + Q, \quad (5)$$

where  $P_{t|\tau} = E[(\alpha_{t|\tau} - \alpha_t)(\alpha_{t|\tau} - \alpha_t)']$  is the estimation of the covariance matrix of the state vector with the available information until the last period  $\tau$ .

Given the information, the vector of indicators  $Z_t$  can be predicted at the period  $t$  according to:

$$Z_{t|t-1} = L \alpha_{t|t-1} \quad (6)$$

---

<sup>7</sup>See for example Duarte and Süßmuth (2014)

and the forecast error would be:

$$v_{t|t-1} = Z_t - L\alpha_{t|t-1}. \quad (7)$$

The covariance matrix would be given by:

$$E[v_t v_t'] = F_t = LP_{t|t-1}L'. \quad (8)$$

Equations 4 to 8 are used to obtain a priori estimates of the values for the state ( $\alpha_t$ ) given some arbitrary initial values  $\alpha_{0|0}$  and  $P_{0|0}$ . After the a priori estimate, an a posteriori update is done using:

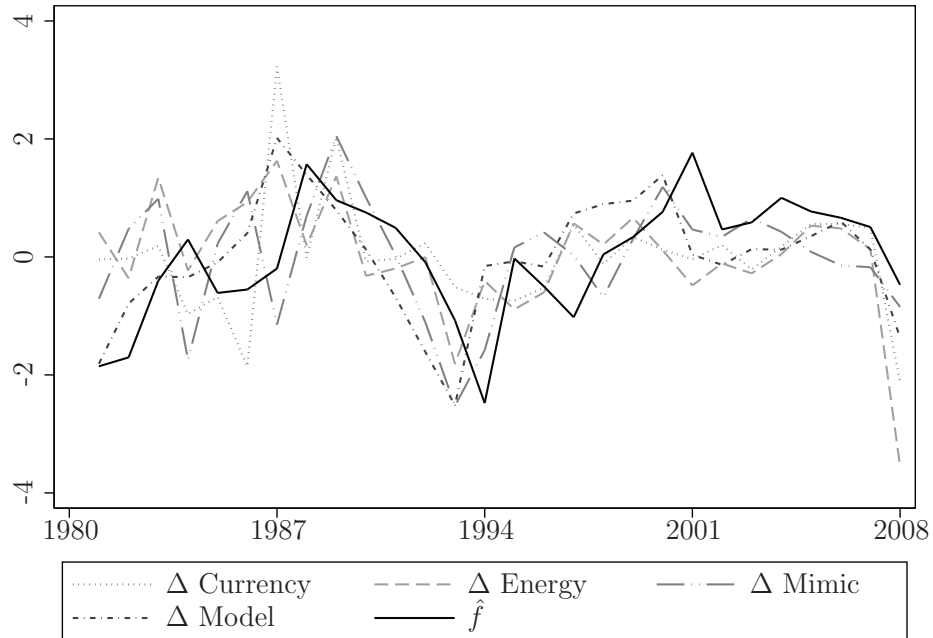
$$\alpha_{t|t} = \alpha_{t|t-1} + P_{t|t-1}L'F_t^{-1}v_t \quad (9)$$

and

$$P_{t|t} = P_{t|t-1} - P_{t|t-1}L'F_t^{-1}LP_{t|t-1}. \quad (10)$$

The same procedure is done recursively again with the updated values for  $\alpha_t$  and  $P_t$ . Finally, the log likelihood function is computed and the function maximized to estimate the coefficients.

Figure 3: Informal Economy Common Factor: 1980 - 2008



Source: Arrazola *et al.* (2011), Elgin and Oztunali (2012) and own calculations. The graph shows the standardized variables.

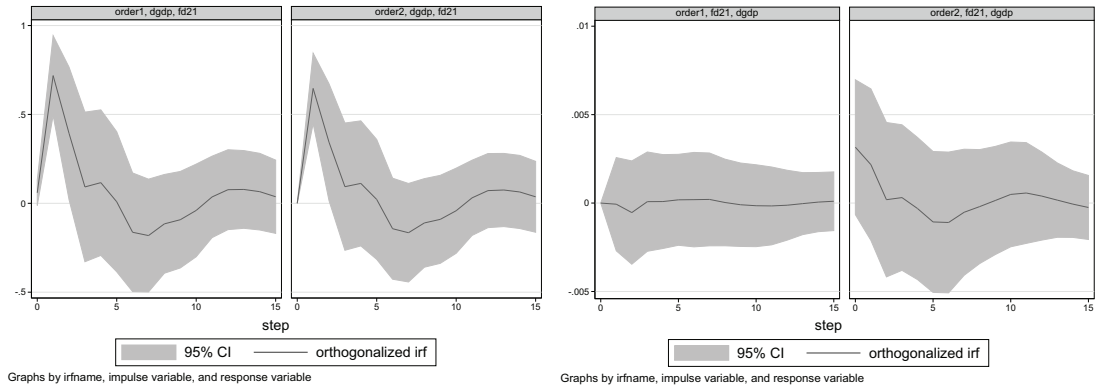
The final specification for the dynamic factor model corresponding to the lowest information criteria (AIC and BIC) is obtained at one lag for  $f_t$  ( $p = 1$ ) and two for  $u_t$  ( $q = 2$ ).<sup>8</sup> This suggests that a dynamic factor model is more accurate than a strict factor model ( $p = q = 0$ ) for the estimation of the common factor. All factor loadings are statistically significant. Figure 3 shows the estimated factor ( $\hat{f}$ ) and the first log-differences of the four basic informality estimations.

Table 2 shows that  $\Delta GDP$  Granger-causes informality but the informality common factor ( $\hat{f}_t$ ), does not Granger-cause  $\Delta GDP$ . The impulse response functions in Figure 4 show that, irrespective of the Cholesky ordering, a positive GDP shock induces a positive significant response in the size of the Spanish informal sector. On the other hand, a positive informality shock does not provoke any significant responses in the size of the formal economy (GDP).

Table 2: Granger Causality test:  $X$  does not Granger-cause  $Y$  (Wald-Test P-Values)

		$Y$	
		$\Delta GDP$	$\hat{f}$
$X$	$\hat{f}$	0.93	
	$\Delta GDP$		0.00

Figure 4: Impulse Response Functions



<sup>8</sup>The maximum lag order was  $p_{max} = q_{max} = 3$ .

## 5 Conclusion

I examine the link between the size of GDP growth and the size of the informal economy in Spain using four different estimation procedures for the size of the informal economy. I show that the differences in the evidence found in the literature can be traced back to the methods by which the size of the informal sector is estimated. Until the estimation procedures are refined, assertions about the size of the informal economy and its relationship with GDP growth shall be considered carefully.

Assuming that all four informality estimations aim at the same unobservable variable, I calculate a common dynamic factor for the four estimations and examine the link between the common factor and GDP growth. The results show that GDP growth Granger-causes informality, but informality does not Granger-cause GDP growth. The impulse response functions show that a positive GDP growth shock induces a significant positive response of the informal economy, but not vice-versa irrespective of the Cholesky ordering.

Using the informality common factor as an alternative measure of the size of informality, the tax-evasion view does not seem to be a suitable perspective for the Spanish case. As the evidence above shows, informal markets are rather a complement than a competitor of formal markets. Therefore, “combating” informality, the policy implication of the tax-evasion view, will not have the claimed positive GDP growth effects. From the legal-institutional perspective, the complementarity of both formal and informal markets imply that structural reforms which allow for formal labor and production (such as working visas) would enlarge formal markets by enabling the complementary activities to become formal and that new formal firms will not necessarily compete against established formal firms. The fact that GDP does not react to changes in the size of the informal sector implies that formal and informal production partly take place in different scenarios and that the informal sector depends on the formal one but not vice versa.



## References

- ARRAZOLA, M., HEVIA, J. D., MAULEÓN, I. and SÁNCHEZ, R. (2011). La economía sumergida en España. In *Dos ensayos de actualidad sobre la economía Española*, Fundación de las Cajas de Ahorros (FUNCAS), pp. 13 – 77.
- BAJADA, C. and SCHNEIDER, F. (2005). The shadow economies of the Asia-Pacific. *Pacific Economic Review*, **10** (3), 379–401.
- BIRINCI, S. (2013). Trade openness, growth, and informality: Panel VAR evidence from OECD economies. *Economics Bulletin*, **33** (1), 694–705.
- BOVI, M. (2004). *Underground Shocks Ground Zero Responses*. Public Economics 0408003, EconWPA.
- and DELL’ANNO, R. (2010). The changing nature of the OECD shadow economy. *Journal of Evolutionary Economics*, **20** (1), 19–48.
- BREITUNG, J. and EICKMEIER, S. (2006). Dynamic factor models. *Allgemeines Statistisches Archiv*, **90** (1), 27–42.
- BREUSCH, T. (2005). *Estimating the Underground Economy using MIMIC Models*. Econometrics 0507003, EconWPA.
- DE SOTO, H. (1989). *The Other Path*. Harper and Row Publishers.
- (2000). *The Mystery of Capital. Why the Capitalism Triumphs in the West and Fails Everywhere Else*. Transworld Publishers.
- DELL’ANNO, R. (2008). *What is the relationship between Unofficial and Official Economy? An analysis in Latin American Countries*. Quaderni DSEMS 23-2008, Dipartimento di Scienze Economiche, Matematiche e Statistiche, Università di Foggia.
- DUARTE, P. and SÜSSMUTH, B. (2014). *Robust Implementation of a Parsimonious Dynamic Factor Model to Nowcast GDP*. CESifo Working Paper Series 4574, CESifo Group Munich.
- EILAT, Y. and ZINNES, C. (2002). The shadow economy in transition countries: Friend or foe? a policy perspective. *World Development*, **30** (7), 1233 – 1254.

- ELGIN, C. and OZTUNALI, O. (2012). *Shadow Economies around the World: Model Based Estimates*. Working Papers 2012/05, Bogazici University, Department of Economics.
- FARRELL, D. (2004). The hidden dangers of the informal economy. *The McKinsey Quarterly*, **3**, 27–37.
- FEIGE, E. L. and URBAN, I. (2008). Measuring underground (unobserved, non-observed, unrecorded) economies in transition countries: Can we trust GDP? *Journal of Comparative Economics*, **36** (2), 287 – 306.
- FELD, L. P. and SCHNEIDER, F. (2010). Survey on the shadow economy and undeclared earnings in OECD countries. *German Economic Review*, **11**, 109–149.
- GILES, D. E. A. (1997). Causality between the measured and underground economies in New Zealand. *Applied Economics Letters*, **4** (1), 63 – 67.
- , TEDDS, L. M. and WERKNEH, G. (2002). The Canadian underground and measured economies: Granger causality results. *Applied Economics*, **34** (18), 2347 – 2352.
- KAUFMANN, D. and KALIBERDA, A. (1996). Integrating the unofficial economy into the dynamics of post socialist economies: a framework of analyses and evidence. In B. Kaminski (ed.), *Economic Transition in Russia and the New States of Eurasia*, M.E. Sharpe, London, pp. 81–120.
- LACKÓ, M. (2000). Hidden economy - an unknown quantity? comparative analysis of hidden economies in transition countries, 1989-95. *The Economics of Transition*, **8** (1), 117–149.
- LOAYZA, N. V. (1996). The economics of the informal sector: a simple model and some empirical evidence from Latin America. *Carnegie-Rochester Conference Series on Public Policy*, **45** (0), 129 – 162.
- MARTINEZ-LOPEZ, D. (2012). The underreporting of income by self-employed workers in Spain. *SERIEs*, pp. 1–19.
- PERRY, G. E., MALONEY, W. F., ARIAS, O. S., FAJNZYLBER, P., MASON, A. D. and SAAVEDRA-CHANDUVI, J. (2007). *Informality : Exit and Exclusion*. No. 6730 in World Bank Publications, The World Bank.

- PORTA, R. L. and SHLEIFER, A. (2008). The unofficial economy and economic development. *Brookings Papers on Economic Activity*, **39** (2 (Fall)), 275–363.
- SCHNEIDER, F. (2005). Shadow economies around the world: what do we really know? *European Journal of Political Economy*, **21** (3), 598–642.
- , BUEHN, A. and MONTENEGRO, C. (2010). New estimates for the shadow economies all over the world. *International Economic Journal*, **24** (4), 443–461.
- and BÜHN, A. (2013). *Estimating the Size of the Shadow Economy: Methods, Problems and Open Questions*. CESifo Working Paper Series 4448, CESifo Group Munich.
- and ENSTE, D. H. (2000). Shadow economies: Size, causes, and consequences. *Journal of Economic Literature*, **38** (1), 77–114.
- SERRANO SANZ, J. M. and GADEA, M. D. (2005). What causes the hidden economy in Spain? *Applied Financial Economics Letters*, **1** (3), 143–150.
- STOCK, J. and WATSON, M. (2010). Dynamic factor models. In M. Clements and D. Hendry (eds.), *Oxford Handbook of Economic Forecasting*, 2.
- TANZI, V. (1983). The underground economy in the United States: Annual estimates, 1930–80. *IMF Staff Papers*, **30** (2), 283–305.
- VANBERG, V. (2001). Markets and the law. In N. J. Smelser and P. B. Baltes (eds.), *International Encyclopedia of the Social & Behavioral Sciences*, Oxford: Pergamon, pp. 9221 – 9227.

# Universität Leipzig

## Wirtschaftswissenschaftliche Fakultät

Nr. 1	Wolfgang Bernhardt	Stock Options wegen oder gegen Shareholder Value? Vergütungsmodelle für Vorstände und Führungskräfte 04/1998
Nr. 2	Thomas Lenk / Volkmar Teichmann	Bei der Reform der Finanzverfassung die neuen Bundesländer nicht vergessen! 10/1998
Nr. 3	Wolfgang Bernhardt	Gedanken über Führen – Dienen – Verantworten 11/1998
Nr. 4	Kristin Wellner	Möglichkeiten und Grenzen kooperativer Standortgestaltung zur Revitalisierung von Innenstädten 12/1998
Nr. 5	Gerhardt Wolff	Brauchen wir eine weitere Internationalisierung der Betriebswirtschaftslehre? 01/1999
Nr. 6	Thomas Lenk / Friedrich Schneider	Zurück zu mehr Föderalismus: Ein Vorschlag zur Neugestaltung des Finanzausgleichs in der Bundesrepublik Deutschland unter besonderer Berücksichtigung der neuen Bundesländer 12/1998
Nr. 7	Thomas Lenk	Kooperativer Förderalismus – Wettbewerbsorientierter Förderalismus 03/1999
Nr. 8	Thomas Lenk / Andreas Mathes	EU – Osterweiterung – Finanzierbar? 03/1999
Nr. 9	Thomas Lenk / Volkmar Teichmann	Die fiskalischen Wirkungen verschiedener Forderungen zur Neugestaltung des Länderfinanzausgleichs in der Bundesrepublik Deutschland: Eine empirische Analyse unter Einbeziehung der Normenkontrollanträge der Länder Baden-Württemberg, Bayern und Hessen sowie der Stellungnahmen verschiedener Bundesländer 09/1999
Nr. 10	Kai-Uwe Graw	Gedanken zur Entwicklung der Strukturen im Bereich der Wasserversorgung unter besonderer Berücksichtigung kleiner und mittlerer Unternehmen 10/1999
Nr. 11	Adolf Wagner	Materialien zur Konjunkturforschung 12/1999
Nr. 12	Anja Birke	Die Übertragung westdeutscher Institutionen auf die ostdeutsche Wirklichkeit – ein erfolg-versprechendes Zusammenspiel oder Aufdeckung systematischer Mängel? Ein empirischer Bericht für den kommunalen Finanzausgleich am Beispiel Sachsen 02/2000
Nr. 13	Rolf H. Hasse	Internationaler Kapitalverkehr in den letzten 40 Jahren – Wohlstandsmotor oder Krisenursache? 03/2000
Nr. 14	Wolfgang Bernhardt	Unternehmensführung (Corporate Governance) und Hauptversammlung 04/2000
Nr. 15	Adolf Wagner	Materialien zur Wachstumsforschung 03/2000
Nr. 16	Thomas Lenk / Anja Birke	Determinanten des kommunalen Gebührenaufkommens unter besonderer Berücksichtigung der neuen Bundesländer 04/2000
Nr. 17	Thomas Lenk	Finanzwirtschaftliche Auswirkungen des Bundesverfassungsgerichtsurteils zum Länderfinanzausgleich vom 11.11.1999 04/2000
Nr. 18	Dirk Büttel	Continuous linear utility for preferences on convex sets in normal real vector spaces 05/2000
Nr. 19	Stefan Dierkes / Stephanie Hanrath	Steuerung dezentraler Investitionsentscheidungen bei nutzungsabhängigem und nutzungsunabhängigem Verschleiß des Anlagenvermögens 06/2000
Nr. 20	Thomas Lenk / Andreas Mathes / Olaf Hirschfeld	Zur Trennung von Bundes- und Landeskompetenzen in der Finanzverfassung Deutschlands 07/2000
Nr. 21	Stefan Dierkes	Marktwerte, Kapitalkosten und Betafaktoren bei wertabhängiger Finanzierung 10/2000
Nr. 22	Thomas Lenk	Intergovernmental Fiscal Relationships in Germany: Requirement for New Regulations? 03/2001
Nr. 23	Wolfgang Bernhardt	Stock Options – Aktuelle Fragen Besteuerung, Bewertung, Offenlegung 03/2001

Nr. 24	Thomas Lenk	Die „kleine Reform“ des Länderfinanzausgleichs als Nukleus für die „große Finanzverfassungs-reform“? 10/2001
Nr. 25	Wolfgang Bernhardt	Biotechnologie im Spannungsfeld von Menschenwürde, Forschung, Markt und Moral Wirtschaftsethik zwischen Beredsamkeit und Schweigen 11/2001
Nr. 26	Thomas Lenk	Finanzwirtschaftliche Bedeutung der Neuregelung des bundestaatlichen Finanzausgleichs – Eine allokoative und distributive Wirkungsanalyse für das Jahr 2005 11/2001
Nr. 27	Sören Bär	Grundzüge eines Tourismusmarketing, untersucht für den Südraum Leipzig 05/2002
Nr. 28	Wolfgang Bernhardt	Der Deutsche Corporate Governance Kodex: Zuwahl (comply) oder Abwahl (explain)? 06/2002
Nr. 29	Adolf Wagner	Konjunkturtheorie, Globalisierung und Evolutionsökonomik 08/2002
Nr. 30	Adolf Wagner	Zur Profilbildung der Universitäten 08/2002
Nr. 31	Sabine Klinger / Jens Ulrich / HansJoachim Rudolph	Konjunktur als Determinante des Erdgasverbrauchs in der ostdeutschen Industrie? 10/2002
Nr. 32	Thomas Lenk / Anja Birke	The Measurement of Expenditure Needs in the Fiscal Equalization at the Local Level Empirical Evidence from German Municipalities 10/2002
Nr. 33	Wolfgang Bernhardt	Die Lust am Fliegen Eine Parabel auf viel Corporate Governance und wenig Unternehmensführung 11/2002
Nr. 34	Udo Hielscher	Wie reich waren die reichsten Amerikaner wirklich? (US-Vermögensbewertungsindex 1800 – 2000) 12/2002
Nr. 35	Uwe Haubold / Michael Nowak	Risikoanalyse für Langfrist-Investments Eine simulationsbasierte Studie 12/2002
Nr. 36	Thomas Lenk	Die Neuregelung des bundesstaatlichen Finanzausgleichs auf Basis der Steuerschätzung Mai 2002 und einer aktualisierten Bevölkerungsstatistik 12/2002
Nr. 37	Uwe Haubold / Michael Nowak	Auswirkungen der Renditeverteilungsannahme auf Anlageentscheidungen Eine simulationsbasierte Studie 02/2003
Nr. 38	Wolfgang Bernhard	Corporate Governance Kodex für den Mittel-Stand? 06/2003
Nr. 39	Hermut Kormann	Familienunternehmen: Grundfragen mit finanzwirtschaftlichen Bezug 10/2003
Nr. 40	Matthias Folk	Launhardtsche Trichter 11/2003
Nr. 41	Wolfgang Bernhardt	Corporate Governance statt Unternehmensführung 11/2003
Nr. 42	Thomas Lenk / Karolina Kaiser	Das Prämienmodell im Länderfinanzausgleich – Anreiz- und Verteilungsmittelnwirkungen 11/2003
Nr. 43	Sabine Klinger	Die Volkswirtschaftliche Gesamtrechnung des Haushaltsektors in einer Matrix 03/2004
Nr. 44	Thomas Lenk / Heide Köpping	Strategien zur Armutsbekämpfung und –vermeidung in Ostdeutschland: 05/2004
Nr. 45	Wolfgang Bernhardt	Sommernachtsfantasien Corporate Governance im Land der Träume. 07/2004
Nr. 46	Thomas Lenk / Karolina Kaiser	The Premium Model in the German Fiscal Equalization System 12/2004
Nr. 47	Thomas Lenk / Christine Falken	Komparative Analyse ausgewählter Indikatoren des Kommunalwirtschaftlichen Gesamt-ergebnisses 05/2005
Nr. 48	Michael Nowak / Stephan Barth	Immobilienanlagen im Portfolio institutioneller Investoren am Beispiel von Versicherungsunternehmen Auswirkungen auf die Risikosituation 08/2005

Nr. 49	Wolfgang Bernhardt	Familiengesellschaften – Quo Vadis? Vorsicht vor zu viel „Professionalisierung“ und Ver-Fremdung 11/2005
Nr. 50	Christian Milow	Der Griff des Staates nach dem Währungsgold 12/2005
Nr. 51	Anja Eichhorst / Karolina Kaiser	The Institutional Design of Bailouts and Its Role in Hardening Budget Constraints in Federations 03/2006
Nr. 52	Ullrich Heilemann / Nancy Beck	Die Mühlen der Ebene – Regionale Wirtschaftsförderung in Leipzig 1991 bis 2004 08/2006
Nr. 53	Gunther Schnabl	Die Grenzen der monetären Integration in Europa 08/2006
Nr. 54	Hermut Kormann	Gibt es so etwas wie typisch mittelständige Strategien? 11/2006
Nr. 55	Wolfgang Bernhardt	(Miss-)Stimmung, Bestimmung und Mitbestimmung Zwischen Juristentag und Biedenkopf-Kommission 11/2006
Nr. 56	Ullrich Heilemann / Annika Blaschzik	Indicators and the German Business Cycle A Multivariate Perspective on Indicators of Ifo, OECD, and ZEW 01/2007
Nr. 57	Ullrich Heilemann	“The Soul of a new Machine” zu den Anfängen des RWI-Konjunkturmodells 12/2006
Nr. 58	Ullrich Heilemann / Roland Schuhr / Annika Blaschzik	Zur Evolution des deutschen Konjunkturzyklus 1958 bis 2004 Ergebnisse einer dynamischen Diskriminanzanalyse 01/2007
Nr. 59	Christine Falken / Mario Schmidt	Kameralistik versus Doppik Zur Informationsfunktion des alten und neuen Rechnungswesens der Kommunen Teil I: Einführende und Erläuternde Betrachtungen zum Systemwechsel im kommunalen Rechnungswesen 01/2007
Nr. 60	Christine Falken / Mario Schmidt	Kameralistik versus Doppik Zur Informationsfunktion des alten und neuen Rechnungswesens der Kommunen Teil II Bewertung der Informationsfunktion im Vergleich 01/2007
Nr. 61	Udo Hielscher	Monti della città di firenze Innovative Finanzierungen im Zeitalter Der Medici. Wurzeln der modernen Finanzmärkte 03/2007
Nr. 62	Ullrich Heilemann / Stefan Wappler	Sachsen wächst anders Konjunkturelle, sektorale und regionale Bestimmungsgründe der Entwicklung der Bruttowertschöpfung 1992 bis 2006 07/2007
Nr. 63	Adolf Wagner	Regionalökonomik: Konvergierende oder divergierende Regionalentwicklungen 08/2007
Nr. 64	Ullrich Heilemann / Jens Ulrich	Good bye, Professir Phillips? Zum Wandel der Tariflohndeterminanten in der Bundesrepublik 1952 – 2004 08/2007
Nr. 65	Gunther Schnabl / Franziska Schobert	Monetary Policy Operations of Debtor Central Banks in MENA Countries 10/2007
Nr. 66	Andreas Schäfer / Simone Valente	Habit Formation, Dynastic Altruism, and Population Dynamics 11/2007
Nr. 67	Wolfgang Bernhardt	5 Jahre Deutscher Corporate Governance Kodex Eine Erfolgsgeschichte? 01/2008
Nr. 68	Ullrich Heilemann / Jens Ulrich	Viel Lärm um wenig? Zur Empirie von Lohnformeln in der Bundesrepublik 01/2008
Nr. 69	Christian Groth / Karl-Josef Koch / Thomas M. Steger	When economic growth is less than exponential 02/2008
Nr. 70	Andreas Bohne / Linda Kochmann	Ökonomische Umweltbewertung und endogene Entwicklung peripherer Regionen Synthese einer Methodik und einer Theorie 02/2008
Nr. 71	Andreas Bohne / Linda Kochmann / Jan Slavík / Lenka Slavíková	Deutsch-tschechische Bibliographie Studien der kontingenten Bewertung in Mittel- und Osteuropa 06/2008

Nr. 72	Paul Lehmann / Christoph Schröter-Schlaack	Regulating Land Development with Tradable Permits: What Can We Learn from Air Pollution Control? 08/2008
Nr. 73	Ronald McKinnon / Gunther Schnabl	China's Exchange Rate Impasse and the Weak U.S. Dollar 10/2008
Nr. 74	Wolfgang Bernhardt	Managervergütungen in der Finanz- und Wirtschaftskrise Rückkehr zu (guter) Ordnung, (klugem) Maß und (vernünftigem) Ziel? 12/2008
Nr. 75	Moritz Schularick / Thomas M. Steger	Financial Integration, Investment, and Economic Growth: Evidence From Two Eras of Financial Globalization 12/2008
Nr. 76	Gunther Schnabl / Stephan Freitag	An Asymmetry Matrix in Global Current Accounts 01/2009
Nr. 77	Christina Ziegler	Testing Predictive Ability of Business Cycle Indicators for the Euro Area 01/2009
Nr. 78	Thomas Lenk / Oliver Rottmann / Florian F. Woitek	Public Corporate Governance in Public Enterprises Transparency in the Face of Divergent Positions of Interest 02/2009
Nr. 79	Thomas Steger / Lucas Bretschger	Globalization, the Volatility of Intermediate Goods Prices, and Economic Growth 02/2009
Nr. 80	Marcela Munoz Escobar / Robert Holländer	Institutional Sustainability of Payment for Watershed Ecosystem Services. Enabling conditions of institutional arrangement in watersheds 04/2009
Nr. 81	Robert Holländer / WU Chunyou / DUAN Ning	Sustainable Development of Industrial Parks 07/2009
Nr. 82	Georg Quaas	Realgrößen und Preisindizes im alten und im neuen VGR-System 10/2009
Nr. 83	Ulrich Heilemann / Hagen Findeis	Empirical Determination of Aggregate Demand and Supply Curves: The Example of the RWI Business Cycle Model 12/2009
Nr. 84	Gunther Schnabl / Andreas Hoffmann	The Theory of Optimum Currency Areas and Growth in Emerging Markets 03/2010
Nr. 85	Georg Quaas	Does the macroeconomic policy of the global economy's leader cause the worldwide asymmetry in current accounts? 03/2010
Nr. 86	Volker Grossmann / Thomas M. Steger / Timo Trimborn	Quantifying Optimal Growth Policy 06/2010
Nr. 87	Wolfgang Bernhardt	Corporate Governance Kodex für Familienunternehmen? Eine Widerrede 06/2010
Nr. 88	Philipp Mandel / Bernd Süßmuth	A Re-Examination of the Role of Gender in Determining Digital Piracy Behavior 07/2010
Nr. 89	Philipp Mandel / Bernd Süßmuth	Size Matters. The Relevance and Hicksian Surplus of Agreeable College Class Size 07/2010
Nr. 90	Thomas Kohstall / Bernd Süßmuth	Cyclic Dynamics of Prevention Spending and Occupational Injuries in Germany: 1886-2009 07/2010
Nr. 91	Martina Padmanabhan	Gender and Institutional Analysis. A Feminist Approach to Economic and Social Norms 08/2010
Nr. 92	Gunther Schnabl / Ansgar Belke	Finanzkrise, globale Liquidität und makroökonomischer Exit 09/2010
Nr. 93	Ulrich Heilemann / Roland Schuhr / Heinz Josef Münch	A "perfect storm"? The present crisis and German crisis patterns 12/2010
Nr. 94	Gunther Schnabl / Holger Zemanek	Die Deutsche Wiedervereinigung und die europäische Schuldenkrise im Lichte der Theorie optimaler Währungsräume 06/2011
Nr. 95	Andreas Hoffmann / Gunther Schnabl	Symmetrische Regeln und asymmetrisches Handeln in der Geld- und Finanzpolitik 07/2011
Nr. 96	Andreas Schäfer / Maik T. Schneider	Endogenous Enforcement of Intellectual Property, North-South Trade, and Growth 08/2011
Nr. 97	Volker Grossmann / Thomas M. Steger / Timo Trimborn	Dynamically Optimal R&D Subsidization 08/2011

Nr. 98	Erik Gawel	Political drivers of and barriers to Public-Private Partnerships: The role of political involvement 09/2011
Nr. 99	André Casajus	Collusion, symmetry, and the Banzhaf value 09/2011
Nr. 100	Frank Hüttner / Marco Sunder	Decomposing $R^2$ with the Owen value 10/2011
Nr. 101	Volker Grossmann / Thomas M. Steger / Timo Trimborn	The Macroeconomics of TANSTAAFL 11/2011
Nr. 102	Andreas Hoffmann	Determinants of Carry Trades in Central and Eastern Europe 11/2011
Nr. 103	Andreas Hoffmann	Did the Fed and ECB react asymmetrically with respect to asset market developments? 01/2012
Nr. 104	Christina Ziegler	Monetary Policy under Alternative Exchange Rate Regimes in Central and Eastern Europe 02/2012
Nr. 105	José Abad / Axel Löffler / Gunther Schnabl / Holger Zemanek	Fiscal Divergence, Current Account and TARGET2 Imbalances in the EMU 03/2012
Nr. 106	Georg Quaas / Robert Köster	Ein Modell für die Wirtschaftszweige der deutschen Volkswirtschaft: Das "MOGBOT" (Model of Germany's Branches of Trade)
Nr. 107	Andreas Schäfer / Thomas Steger	Journey into the Unknown? Economic Consequences of Factor Market Integration under Increasing Returns to Scale 04/2012
Nr. 108	Andreas Hoffmann / Björn Urbansky	Order, Displacements and Recurring Financial Crises 06/2012
Nr. 109	Finn Marten Körner / Holger Zemanek	On the Brink? Intra-euro area imbalances and the sustainability of foreign debt 07/2012
Nr. 110	André Casajus / Frank Hüttner	Nullifying vs. dummifying players or nullified vs. dummified players: The difference between the equal division value and the equal surplus division value 07/2012
Nr. 111	André Casajus	Solidarity and fair taxation in TU games 07/2012
Nr. 112	Georg Quaas	Ein Nelson-Winter-Modell der deutschen Volkswirtschaft 08/2012
Nr. 113	André Casajus / Frank Hüttner	Null players, solidarity, and the egalitarian Shapley values 08/2012
Nr. 114	André Casajus	The Shapley value without efficiency and additivity 11/2012
Nr. 115	Erik Gawel	Neuordnung der W-Besoldung: Ausgestaltung und verfassungsrechtliche Probleme der Konsumtionsregeln zur Anrechnung von Leistungsbezügen 02/2013
Nr. 116	Volker Grossmann / Andreas Schäfer / Thomas M. Steger	Migration, Capital Formation, and House Prices 02/2013
Nr. 117	Volker Grossmann / Thomas M. Steger	Optimal Growth Policy: the Role of Skill Heterogeneity 03/2013
Nr. 118	Guido Heineck / Bernd Süßmuth	A Different Look at Lenin's Legacy: Social Capital and Risk Taking in the Two Germanies 03/2013
Nr. 119	Andreas Hoffmann	The Euro as a Proxy for the Classical Gold Standard? Government Debt Financing and Political Commitment in Historical Perspective 05/2013
Nr. 120	Andreas Hoffmann / Axel Loeffler	Low Interest Rate Policy and the Use of Reserve Requirements in Emerging Markets 05/2013
Nr. 121	Gunther Schnabl	The Global Move into the Zero Interest Rate and High Debt Trap 07/2013
Nr. 122	Axel Loeffler / Gunther Schnabl / Franziska Schobert	Limits of Monetary Policy Autonomy and Exchange Rate Flexibility by East Asian Central Banks 08/2013
Nr. 123	Burkhard Heer / Bernd Süßmuth	Tax Bracket Creep and its Effects on Income Distribution 08/2013
Nr. 124	Hans Fricke / Bernd Süßmuth	Growth and Volatility of Tax Revenues in Latin America 08/2013
Nr. 125	Ulrich Volz	RMB Internationalisation and Currency Co-operation in East Asia 09/2013



Nr. 126      André Casajus / Helfried Labrenz

A property rights based consolidation approach  
02/2014

Nr. 127      Pablo Duarte

The Relationship between GDP and the Size of the Informal Economy: Empirical Evidence for Spain  
02/2014