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Revealed Informal Activity

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Abstract: What does it mean to be in the informal sector? Many characterizations have been used in the literature, for example, firms that are unregistered or employ a small workforce or firms/economic enterprises that do not have access to formal capital markets. But many people participate in both formal and informal activities, while classification of participation is often based on primary employment. We develop a method for assigning households to the informal sector by inferring informal sector activity using income and expenditure surveys. We apply this method to the case of Bulgaria using LSMS income and expenditure surveys before and after a significant economic reform. We show how our assignment rule behaves under a number of variations, and compare the assignment to assignments made using other indicators of informal sector activity. Our work shows the informal sector acting as a buffer for households during periods of crisis when formal sector employment opportunities are limited. In this sense the presence of an informal sector provides a "safety net" and is welfare improving.

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Revealed Informal Activity

In order to perform economic analysis on the effectiveness of policies aimed at those individuals who derive income from informal sector activity we first need to have accurate measurements of informal sector activity. If we are to perform economic analysis at a disaggregated level we also need to be able to allocate households (or individuals) into the informal sector.[1] Here the biggest hurdle to formal economic analysis is that the informal sector is hard to define and hard to measure. The difficulty in measuring the informal sector makes it difficult to say anything economically concrete about the nature of the informal sector and its participants. We define a new procedure which, using existing data sets, will allow us to statistically measure the informal sector. With this new method in hand we will then be able to make formal inferences about the informal sector and its participants. We are able to use existing data sets to formally analyze the economic forces that drive the movement into and out of the informal sector and to formally analyze economic policies aimed at helping those individuals participating in the informal sector.

In order to undertake our formal econometric analysis of the informal sector we need to be able to classify households (or individuals) that are active in the informal sector. A major open question in the informal sector literature is the definition of what it means to be in the informal sector. Many characterizations have been used in the literature, for example, firms that are unregistered or employ a small workforce or firms/economic enterprises that do not have access to formal capital markets. Independent of the definition of the informal sector, the biggest impediment to the use of formal econometric/statistical methods is the fact that the informal sector is poorly measured, if measured at all, by the national statistical agencies. A related problem is that when there is an effort to collect data on informal sector activity across countries the definitions of what it means to be participating in the informal sector is not consistent. Another issue in dealing with the informal sector is that many people may participate in both formal and informal activities (e.g. doctors and taxi drivers may participate in both formal and informal activities). All these problems suggest that a new method of inferring informal activity is needed.

A summary of the different rules and methods used to assign individuals to the informal sector can be found in Table 1.

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[1]Later in this note we discuss the use of household vs. individual observations.

Table 1: Summary of Measures of Informal Sector	
Microstudy	**Rule of assigning informal sector**
Gasparini and Tornarolli (2006)	An individual is considered an informal worker if (s)he belongs to any of the following categories: (i) unskilled self-employed, (ii) salaried worker in a small private firm, (iii) zero-income worker
Gasparini and Tornarolli (2006)	A salaried worker is informal if s(he) does not have the right to a pension linked to employment when retired.
Prahan and van Soest (1995, 1997) and Maloney (1999)	In their studies, they use the rule which is fewer than six employees for Bolivia and Mexico respectively.
Funkhouser (1996)	Uses fewer than five employees for an analysis of five Central American economies.
Marcoullier et al. (1997)	Use fewer than six for Mexico and Peru.
Cohen and House (1996)	Use fewer than 20 for Sudan.
Livingstone (1991)	uses fewer than ten for Kenya
Galli and Kucera (2004)	Undertake an international comparative study across 14 Latin America countries. They employ a definition adopted by the ILO based on employees in firms of either fewer than 5 or 10 employees (depending on the country).
Merrick (1976), Portes et al. (1986), Marcouiller et al. (1997), Maloney (1999) and Saavedra and Chong (1999).	Use the principal of informality is defined by social protection status. : the criterion of no social protection or non-payment of social security taxes for distinguishing informal employees.
Bosch and Maloney (2007)	This paper divides the labor force into three sectors of work: formal salaried, informal salaried and self-employed. While the term "informal" suffers from overly broad and imprecise usage, it refers here to owners (self-employed) and workers (informal salaried) who do not have social security or medical benefits and are therefore not protected. Formal salaried workers are defined as those enjoying labor protections.
Martha Alter Chen (2007)	The informal economy is comprised of all forms of informal employment— that is, employment without labour or social protection—both inside and outside informal enterprises, including both self-employment in small unregistered enterprises and wage employment in unprotected jobs.
Rauch (1991)	The informal sectors are those firms of a size below which the government chooses not to enforce minimum wages.
Perry et al.(2007)	Informal sector Labor: • workers, particularly the old and young, who would prefer a job with standard labor protections, but are unable to get one; • workers who have quit formal sector jobs to start a microbusiness

	to be their own boss, make more money, and avoid paying social protection taxes; and women leaving formal salaried jobs for the flexibility of balancing home and income-raising responsibilities. Microfirms: • microentrepreneurs with no intention of or potential for growing, and hence no intention of engaging the institutions of civil society; • microentrepreneurs stymied in their expansion by excessively high barriers to registering with the government and thereby accessing other inputs offered by the informal sector. Firms: • firms and individuals avoiding taxation or other mandated regulations because everybody else does, and because enforcement is weak and uneven; • firms registering only part of their workers and part of their sales—or declaring only part of the salary of their workers—due to an excessive regulatory burden.
World Development Indicators (2006)	Share of the labor force not covered by a pension scheme.
International Labour Organisation (2006)	Self-employment is measured as the percentage of self-employed workers (employers, own account workers) and contributing family workers with respect to the employed workers.
Amin (2002)	1. Bangladesh: Formal employment is defined as employment in establishments employing 10 or more workers. By implication the informal sector is comprised with enterprises with less than 10 workers. 2. Cambodia: Any activities which do not have a fix, identifiable postal address; where workers are self-employed; road side vendors; non availability of the data on the business through census survey; labour intensive nature of operations; quick turnover; part-time or full time work; the use of energy input from human and animal source; activities not recognised that take place in a non-structured premises, not under any regulations, license, insurance and do not pay any tax. 3. China: The informal sector in China should refer to small-scale units outside the legally established enterprises. According to organisational forms, three types of such enterprises are distinguished as: micro-enterprises, family enterprises and independent service persons. 4. India According to the Central Statistical Organisation, all unincorporated enterprises and household industries (other than organised ones) which are not regulated by laws and which do not maintain annual accounts or balance sheets constitute the unorganised sector. The Directorate General of Employment and Training (DGET) define the

	organised sector as comprising all establishments in the private sector, which employ 10 or more persons. By implication, the informal sector is comprised of enterprises with less than 10 employees. These are not (a) organised systematically, (b) made formal through mandatory registration or licenses, (c) covered by legislation to protect minimum labour standards in employment and development. 5. Indonesia The informal sector is defined by the Central Bureau of Statistics as individuals over 10 years of age who worked during the previous week as own account workers, self-employed assisted by family members, farmer employees or nonwage family workers. 6. Mongolia The informal sector consists of small-scale, usually family based, economic activities that may be undercounted by official statistics, and may not be subject, in practice, to the same set of regulations and taxation as formal enterprises. 7. Philippines The informal sector includes activities by self-employed with or without unpaid family workers, and those employed in enterprises with less than 10 persons. 8. Sri Lanka The informal sector is defined to include enterprises and activities, which employ less than five persons, mainly from family sources. Investment in buildings and equipment is quite low, the technology is labour-intensive, management systems are simple with minimum documented controls, and the technical know-how and skills are acquired from the informal educational system. 9. Thailand The National Statistical Office (NSO) defines the informal sector to include enterprises typically operating with a low level of organisation on a small-scale, low and uncertain wages and no social welfare and security. NSO also defines the formal sector as employing at least 10 persons. 10. Vietnam Officially defined to include small-scale activities characterised by selfemployment, mainly using self-labour and household labourers (usually less than ten), simple technology, low levels of organisation and unfixed operation of premises and working hours. 11. Tanzania The informal economy is measured according to the volume of retail trade, volume of travel per capita, the degree of urbanisation and the level of income taxation.

One characteristic that we require of any method to infer informal activity is that the method must be flexible to include all types of informal activity. We also want to

locate informal sector activity without the restriction of defining informal activity. The analogous approach to our method is that of revealed preference. An individual's preferences (or utility) cannot be observed directly but we can make inferences about their preferences through their revealed actions. This is what we plan to do in measuring the informal sector. We will use observed household and individual behavior to make formal inferences about their informal sector activity.

Here using income and expenditure surveys. This novel method uses household information about income and expenditure to allocate households (or individuals) to the informal sector. We argue that households that spend considerably more than their total income must be getting income from informal sources. In this context total income is defined to be the sum of labor income, transfers, and the change in asset position. If after accounting for all of these sources of income there is still a large difference in announced income and announced expenditure then we argue that the household is participating in the informal sector. In consuming goods and services in amounts far in excess of what its measured income would suggest, the household (or individual) has "revealed" itself to be participating in the informal sector.

Key to our method is the use of income and expenditures accounts to assign households to the informal sector. The income and expenditures accounts available in the Living Standards Measurement Survey (LSMS)[2] data sets provide a good basis for such an exercise as they incorporate all relevant information on the flow of resources in and out of the household. Specifically, the expenditure accounts incorporate data on all expenditures including durable goods, while the income accounts contain data on both labor and non-labor incomes, including the net incomes from agricultural production and consumption, remittances and savings. Moreover, using certain LSMS data sets (e.g., Bulgaria, 1995 and 1997) we are able to directly account for changes in assets. With the income and expenditure accounts devised in such a way, total expenditures should equal total incomes. Our main idea behind the definition of the informal sector is to assign any household with significant excess of expenditures over incomes to participation in informal sector activities. Clearly this definition of informal activity is quite broad but one of the purposes of this project is to compare our approach of measuring the informal

[2] http://go.worldbank.org/IPLXWMCNJ0

sector with other approaches. Once this is carefully done we will be able to give guidance to practitioners as to what threshold values to use so that the informal sector activity that we identify accords with accepted definitions of the informal sector. The elegance in this approach is that we have a deterministic method to infer informal sector activity from established cross-sectional, longitudinal and panel data sets that will allow economic researches to bring all their established tools to bear on important questions regarding the informal sector. One additional but very important outcome of this research would be to identify additional questions that could be included in future LSMS surveys that would greatly improve the measurement of the informal sector.

Up to now our discussion has focused on whether the household was involved in informal sector activity, without addressing which person in the household may have been directly involved in the informal sector. The household is generally the appropriate unit of analysis, as expenditure is difficult to assign to any one individual. Also, while the source of formal sector income can often be assigned to an individual, in keeping with our idea of the informal sector, informal income cannot. For example, the formal sector employee may have a second informal sector job; an apparently non-working member of the household may in fact be employed in the informal sector; or children may be participating in the informal sector. We are able to easily assign households to the informal sector and with some additional information and assumptions we can also assign informal sector income to particular persons in that household. For example, when time use data is available we can allocate informal sector activity to individuals.

The Informal Sector During Crisis: The Case of Bulgaria

In this application we use data from Bulgaria to apply our measure of revealed informal activity. During the period of study Bulgaria underwent significant economic change which will allow us to see how our measure of informal activity compares to the other methods of measuring informal sector activity. We will also be able to study how informal sector activity adjusts to changing economic conditions, especially in times of severe economic stress.

During the first half of the 1990s Bulgaria experienced significant output loss and rising inflation, much more than in most other Central and East European (CEE) countries. Whereas the CEE economies that joined the European Union (EU) in 2004 reached the trough of their output loss in 1991-92 and were able to contain inflation by 1993, Bulgaria's GDP continued to fall through 1993, while hyperinflation was witnessed as late as 1997. This lackluster performance relative to most other CEE countries was largely a result of the absence of reform until the financial crisis of 1996-97.

Reforms were initiated in earnest only after the financial crisis, and they included rapid privatization, reform of the pension and social-welfare structure, and the establishment of a currency board. One of the immediate outcomes of this programme was the transfer of most of Bulgaria's productive resources from public into private hands, such that by the end of the 1990s, the private sector accounted for nearly 70 per cent of the country's GDP (National Statistical Institute 2003; Bulgarian Privatization Agency 2000). In the process, official employment declined at the rate of about 2 per cent per annum and as late as 2001 the unemployment rate was as high as 17.3 per cent, with 62 per cent of the unemployed people remaining unemployed for more than a year. At the same time the unemployment benefit system in Bulgaria remained among of the least generous in Europe (Garibaldi, Makovec and Stoyanova 2001).

The crisis of 1996-97 contributed to not only rapid restructuring and labour shedding, but also to a significant real wage decline, such that by 1997 the average real wage in Bulgaria was 61.1 per cent lower than its 1990 level (Rutkowski 2003). Besides earnings, hyperinflation also eroded savings; indeed much more than in other transition

economies in CEE (Rutkowski 1999; IMF 2002). All of these contributed to a 77 per cent increase in poverty in the 1995-97 period (Sahn *et al.* 2002).

It is interesting to note that despite the low level of unemployment benefits, one of the highest unemployment rates in CEE, and high correlation between unemployment and poverty, reservation wages in Bulgaria remained high throughout the transition period (Rutkowski 1999). This observation, together with the extraordinarily high discouragement rate among unemployed males indicates that a high proportion of the Bulgarian population might have found its way towards the informal economy (Garibaldi et al. 2001). The plausibility of this proposition is further augmented by the extraordinary payroll tax burden in transition Bulgaria, accumulating into a 41 per cent tax wedge between labour costs to employer and take home earnings, as well as by an excessively restrictive business environment leading to a lower number of officially registered Small and Medium Enterprises (SME) than elsewhere in CEE. According to existing macroeconomic estimates, the informal economy in Bulgaria accounts for at least a fourth of the country's GDP (Nenovski and Hristov 2000).

Data and variable descriptions

The data used for our empirical analysis is part of the Living Standards Measurement Surveys (LSMS), provided by the World Bank. The surveys provide detailed information on employment, income, consumption, education and demographic characteristics for all members of about 2500 households in 1995, 1997 and 2001. The surveys are repeated cross-sections and a small panel can be created only for part of the households available in both 1995 and 1997. In this study we only use the cross-sectional elements of each of the surveys.

Key to our analysis is how we assign people to the informal sector. As indicated earlier, we focus on the revealed informal activity of individuals and households by assigning to the informal sectors those households with reported incomes that systematically fall short of their reported expenditures. To do so (and avoid the possibility that these differentials are based on measurement errors), we first define expenditure to income ratios for households for which we feel comfortable in asserting

that no one is in the informal sector. We consider two-worker households in 1995 where both souses state they do not have a second job, and find that their median expenditures exceed median income by 18 per cent. With this information, we assign to the informal sector households, in which household expenditures exceed household incomes by 100 per cent.

As a check on our method we have examined the income and expenditures of households that we strongly believe do not participate in the informal sector. These are households where all working-age individuals are working full-time jobs in either the public or private sectors. In both the 1995 and 2001 surveys we find that for these households the ratio of reported expenditure and reported income is almost identical to one. Given this result we then assign households to informal sector activities if their reported expenditures are greater than twice their reported income. As a robustness check we also examined attributes of the informal and formal sectors when the threshold for informal sector activity is set at 1, 2, and 3. We find that, apart from there being a difference in the overall size of informal sector activity, our results are quite robust to the definition of the threshold value. Our initial thinking is that a threshold of 2 is a conservative threshold that allows for measurement errors in income and expenditure to not greatly affect our allocation of households into informal sector activity.

Our rationale is quite obvious; to fund this lifestyle households must obtain income from somewhere. Borrowing was fairly primitive in Bulgaria at this time (and it is so in a large number of developing countries) and our income measure already includes transfers, incomes from real estate, financial assets and changes in asset positions.

In order to avoid the possibility of a systematic statistical error affecting our exercise, we use as a point of departure a reference household of which we are sure that it belongs to the formal sector. We select married couples[3], in which both the head and spouse are of working age[4], work on a termless contract and a 40- hour week schedule, neither of them reports any second job or self-employment activity and the household

[3] The households of single heads of households in Bulgaria are few and aside from family of divorced individuals, they typically include elderly (widowed) households.

[4] In Bulgaria in the 1990s this means 18-55 for women and 18-60 for men. This is based on the fact that 18 is the age of graduation from compulsory secondary education, while statutory retirement age was 55 for women and 60 for men.

does not own a household business. We exclude from the sample anyone that pursues higher studies at the time of the interview. For a sample of these households we calculate the median seasonally deflated expenditures and incomes for both 1995 and 2001 and then take the ratio of the two. Our results indicate that the ratio of expenditures and incomes is 1.096581 in 1995 and 1.089261 in 2001. In other words, on average, for our reference category of a formal sector household defined in a rather conservative way, total expenditures are approximately equal to total incomes.

Figure 1 highlights the discrepancies between the logarithm of incomes and expenditures for the reference households and compares these discrepancies with those of the total samples for 1995 and 2001. We observe that the overlap between incomes and expenditures is significantly more even for the reference categories than the total sample and assign this difference to the impact of the informal sector.

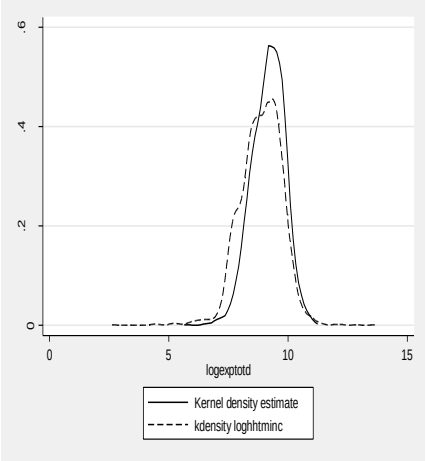
While the ratio of the median expenditures and incomes for the reference household is approximately 1, we prefer to rely on a significantly stricter measure of the informal sector and assign to the informal sector any household for which expenditures exceed income by 100 per cent. In our empirical exercise we experiment with alternative definitions ranging from expenditure-income ratios equal to 1.5 to ratios equal to 2.5. We then explore the impact of different household characteristics on the probability for the household to belong to the informal sector.

We later compare this measure with some stylized measures of informality. Specifically, we define three additional, fairly stylized informality measures. First, we define a dummy variable, taking the value of 1 if anyone in the household works without a contract and or formal labour protection. Secondly, we define a dummy variable, that takes the value of 1 if the household either operates a small business or anyone in the households works as own-account self-employed individual.

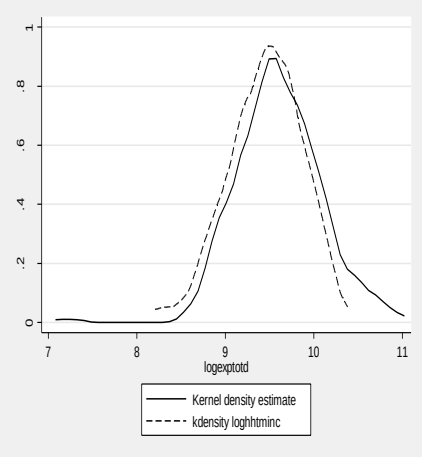
Our control variables are fairly stylized. We control for the age of the head of household (AGE_Hd), as well as the proportion of household members of dependent age groups, namely 0-6, 7-15 and over 60 (Prop6, Prop715, Propgt60). Furthermore, to control for scale effects, we include a variable of the number of resident household members (HHsize).

Figure 1: Distribution of total expenditures and incomes

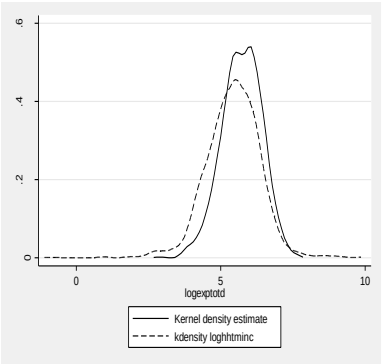
1995: Whole Sample



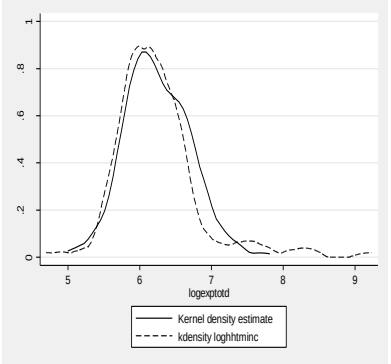
1995: Reference Household



2001: Whole Sample



2001: Reference Household



To account for the differential human capital income of the head of household and different alternative household members, we include both variables that capture the level of education of the head of households (EdSec_Hd, EdVoc_Hd, EdTer_Hd), and variables that capture the education levels of household members other then the head (EdSec_Oth, EdVoc_Oth and EdTer_Oth). The labour market literature on Bulgaria during the 1990s indicates that the type of education acquired has significant impact on

the probability of individuals to obtain a job in the formal labour market (Dimova and Gang, 2007). Hence, we find it important to differentiate between the types of education acquired: university, versus vocational, versus general secondary education, as opposed to the level of education acquired, captured by a number of years of education variable. Based on previous research, our assumption would be that higher levels of education imply higher probability to enter the formal labour market and lower probability to enter the informal labour market. We also assume that the level of education of the household would be more important in making these choices than the level of education of secondary household members (Grimm and Gunter, 2005: paper in our book).

Finally, we define variables of the gender of the head of household (Female_Hd) the assumption being that households headed by females tend to be poorer and therefore more prone to participate in informal activities if informality means a way of escaping poverty. We also define a variable of the ethnic origin of the household (Ethnic_Hd), which is once again a proxy of lower financial status of the household (Garibaldi et al, 2001; Rutkowski, 1999). We also control for the marital status of the head of household (Married_Hd), since some preliminary look at the data indicated that married heads of household tend to aim at higher levels of security and are less prone to being involved in informal activities. As informality is likely to be different between urban and rural areas, we also define a variable Urban, which takes the value of one of the household is located in urban, as opposed to a rural area.

Table 1: Variables used in Probit Regressions

Variable Name	Definition
Age_Hd	Age of head of household
AgeSq_Hd	Squared age of head of household
Married_Hd	=1 if head married
Female_Hd	=1 if head female
Ethnic_Hd	=1 if head member of ethnic minority
EdSec_Hd	=1 if head;s highest education is secondary education
EdVoc_Hd	=1 if head's highest education is vocational education
EdTer_Hd	=1 if head's highest education is University education
EdSec_Oth	Proportion of household with only secondary education
EdVoc_Oth	Proportion of household with vocational education
EdTer_Oth	Proportion of household with University education
Prop6	Proportion of household under the age of 6
Prop715	Proportion of household between the ages of 7 and 15
Propgt60	Proportion of household over the age of 60
HHsize	Size of Household
Urban	=1 if household lives in urban area.

Revealed Informal Activity in Bulgarian Households

We use the Bulgarian income and expenditure data for surveyed households in order to measure the amount of informal activity present in the economy. For what follows we use assign informal activity to all households whose reported expenditure is great than twice their reported "full" income. Full income is defined as income from all labor sources plus net transfers into the household plus consumption of assets, savings and capital. We believe this to a conservative measure of informal sector activity in that

we require that expenditure to be twice that of reported "full" income for the household to participate in the informal sector.

We acknowledge that this threshold is ad hoc and could lead to some households not being assigned to the informal sector when indeed members of the household did participate in informal sector activities but we wanted to make sure that errors in recalling income did not drive our results. As a check on our method we constructed a set of households who a priori we thought were likely candidates to have no informal sector activity. These were households for example, contained only one member who reported to have full time employment and worked more than 35 hours per week. This group of households, for the period that we studied, had expenditures that were roughly equal to their incomes. This suggests that using expenditures relative to income might be useful in inferring informal sector activity.

Of course, one possibility is that some households may actually report all their income including informal sector income in their survey forms. In this case the household will not be assigned to the informal sector when in fact they should have been assigned to the informal sector. Thus we believe that our measure of informal sector behaviour will most likely underestimate the number of households who participate in the informal sector.

For the years 1995, 1997, and 2001 we constructed full income for each household and compared this income with their reported expenditures. If a household's expenditure was more than twice their reported full income then they were assigned to the informal sector.

Table 2 reports the proportion of households with some informal activity using our approach to measuring informal activity and using other common approaches to measure informal sector activity. Two striking differences are apparent in Table 1. The first difference is in the relative sizes of the proportion of households participating in the informal sector. Our preferred measure of informal sector activity estimates that roughly one third of all Bulgarian households that were sampled in 1995 and 2001 participated in the informal sector. In 1997 the proportion of households with some informal sector activity more than doubled. This is in stark contrast to the other measures of informal sector activity. The other measures estimated the proportion of households participating

Table 2: Proportions of Households participating in Informal Sector

Measure of Informal Activity	1995	1997	2001
I1: Revealed Informal Activity	0.354	0.745	0.385
I2: Self-employment	0.069	0.055	0.061
I3: No worker protections	0.064	0.043	0.071
I4=I2 or I3	0.129	0.095	0.129

in the informal sector to be much smaller with the combined measure reporting that only 10 percent of the households sampled had any informal sector activity.

The second glaring difference between our measure of revealed informal sector activity and the other measures is the behaviour of the informal sector during the height of the Bulgarian economic crisis. Our measure of informal sector activity doubles during 1997 which is immediately after the worst of the Bulgarian economic crisis. The Bulgarian crisis of 1996-1997 led to massive layoffs and much lower real wages. Given this type of significant crisis it would be expected that households react by augmenting their formal sector income with informal sector activity. Using the expenditure approach we do see that informal sector activity increases significantly during the crisis but falls back to pre-crisis levels by 2001.

Using the other measures of informal activity such as self-employment and working in jobs that offer little employment protections we see the opposite behaviour. These measures all show a decline in the informal sector during the period of the crisis. This highlights one of the weaknesses of these other measures in that they are employment based measures. In order to be assigned to the informal sector using these measures the household must first report that at least one member of the household is either self-employed or working in a job without employment protections. A household is not reported to be in the informal sector if they don't report working in one or they are laid off from their employment. During the crisis in 1996 and 1997 there was massive job destruction which could be one reason why the size for the informal sector fell for the 1997 sample.

In order to investigate informal activity in more detail we now report marginal effects from simple Probit regression models with informal activity as the dependent variable. As explanatory variables we use various household characteristics such as age of head and age squared to see if informal sector activity is non-linear in age of the head of household. We also include a gender variable to distinguish households whose head are female from other households. Our prior is that these households are likely to be single females. We include information on the educational attainment of the head and of the average educational attainment of the other members of the household. To do this we include dummy variables for an individual's highest qualification. We also include variables that indicate whether a household contains children or pensioners and we include information on the location of the household and its overall size. Table 1 reports the names and definitions of all variables included in the Probit regressions and Tables 3 and 4 report the marginal effects from our Probit regressions for our measure of revealed informal activity and for a combined measure of existing informal definitions which attributes informal activity to a household if it either has some self-employment activity or some member of the household works in a job that offers no formal labor protections.

The results for our measure of revealed informal activity can be found in Table 3. The first result of consequence is that it appears that for 1997 there are few significant explanatory variables. This year is an important year for Bulgaria in that Bulgaria at this time was undergoing a severe economic crisis and was starting a program of significant economic reforms. In Table 2 it is also clear that this year almost three quarters of the households in our sample had some form of informal sector activity. Given the extent of the crisis and the observation that almost all households were participating in the informal sector it is not surprising that there are no clear patterns appearing from the Probit regressions. For the other two years, 1997 and 2001 the results are much clearer. In these years only about a third of all households had some form of informal sector participation and the pattern of results for these two years are quite similar.

The first result that is apparent from the Probit regressions is that there is significantly more informal sector activity in rural areas than in urban areas. In 1995 households whose head are married are less likely to have informal sector activity. This is not the case in 2001. One reason for this might be than in 1995 the public sector was

large and that there was a bias towards older (and hence more likely to be married) employees during this time. In 2001 the economic reforms had taken effect with a much smaller public sector and a much larger private sector which did not have the bias towards married employees (see Dimova, Gang, and Landon-Lane (2006) for a more complete discussion on the decline of the public sector during this period).

Another interesting result is that, while not completely consistent across 1995 and 2001, education has a negative marginal effect on the probability of participating in the informal sector. In 2001 the result is much stronger with both education variables for the head and for the other members of the household being significant and negative for the urban sample. This change from 1995 could be due to the economic reforms to a private economy where education is more rewarded than in the previous socialist regime. This result is not as strong in rural areas. We attribute this result to industries in rural areas not needing formal education.

The age variables are also significant, especially in the urban sample, with the probability of informal sector activity declining at a decreasing rate with the age of the head of the household. Thus as the head of the household gets older it appears that they are more likely to find formal full time employment. . During the period of the crisis in 1997 there is no age effect but this is rather understandable as all households were affected by the crisis.

The makeup of the household also has some affect on informal sector activity. While gender does not play a strong role in the results we observe that households with children under the age of 6 are less likely to have informal sector activity during the years 1995 and 2001 which might reflect that women are likely to be the member of the household that participates in the informal sector but they refrain from this with young children. During the crisis however families with young children were more likely to participate in informal sector activity, which probably reflects the extent of the crisis during this period.

The final interesting result is that in 2001 households whose head were members of an ethnic minority were more likely to have informal sector activity. This result is not present in any of the other periods. One reason for this is that in 1995 the economy was

still transitioning from a socialist economy where there were less discrimination in employment practices than in the private sector oriented economy of 2001.

The results from the Probit analysis for our measure of revealed informal activity, while not exhaustive, do appear to be reasonable in that the explanatory variables have in general the appropriate sign. This cannot be said of the results for the other informal sector activity measure, which is used in the informal sector literature. Table 4 reports the marginal effects from our Probit regression results using the measure of informal activity that uses labor market based definitions. In Table 2 it was clear there was a perverse result that the informal sector, as measured using the labor market based definitions, shrank during the economic crisis of 1996 and 1997. There are few significant results but more importantly our results show that in 2001 a household is more likely to be in the informal sector if it has more education. This is not consistent with the informal sector literature and is most likely due to the nature of formal employment in Bulgaria than it is due to the nature of informal sector in Bulgaria.

Table 3: Marginal effects: revealed informal activity

	1995		1997		2001	
Variable	Full	Urban	Full	Urban	Full	Urban
Age_Hd	-0.006	-0.015***	-0.000	0.000	-0.012***	-0.015***
AgeSq_Hd	-0.005	0.092*	-0.000	-0.000	0.076*	0.095*
Married_Hd	-0.118***	-0.154***	-0.030	-0.055	-0.030	-0.035
Female_Hd	0.060*	0.061	0.010	0.020	0.053*	0.045
Ethnic_Hd	0.046	-0.005	-0.010	-0.065	0.185***	0.139***
EdSec_Hd	-0.003*	0.007	0.018	0.015	-0.029	-0.064*
EdVoc_Hd	-0.010	-0.001	-0.021	-0.004	-0.036	-0.057*
EdTer_Hd	-0.004*	0.004	0.033	0.044	-0.038	-0.071*
EdSec_Oth	-0.168**	-0.010	-0.066	-0.087	-0.088	-0.157**
EdVoc_Oth	-0.158**	-0.092	-0.074	-0.118	-0.120*	-0.166**
EdTer_Oth	-0.267***	-0.202**	-0.052	-0.073	-0.193**	-0.201**
Prop6	-0.041	-0.231*	0.194*	0.293*	-0.179	-0.277**
Prop715	0.008	0.011	0.129	0.045	0.186**	0.058
Propgt60	-0.027	-0.065	0.063	0.081	-0.153***	-0.111**
HHsize	0.009	0.011	0.013	0.035***	0.013	0.022*
Urban	-0.161***		-0.116***		-0.076***	
Sample	2462	1644	2323	1556	2633	1756
Pseudo-R^2	0.059	0.056	0.031	0.025	0.082	0.068

Table 4: Marginal effects: other informal measure (self-employed + no labor protections)

	1995		1997		2001	
Variable	Full	Urban	Full	Urban	Full	Urban
Age_Hd	0.001	0.004*	0.003	0.004	0.002	0.002
AgeSq_Hd	-0.031	-0.100**	-0.032	-0.043	-0.021	-0.028
Married	-0.015	0.003	-0.030	0.021	-0.025	-0.004
Female	-0.026	-0.009	0.011	0.023	-0.030*	-0.011
Ethnic	-0.010	0.021	0.019	-0.006	0.045**	0.052*
EdSec_Hd	0.041*	0.068*	-0.016	-0.014	0.023	0.063**
EdVoc_Hd	-0.003	0.006	0.005	-0.000	0.056***	0.079
EdTer_Hd	0.033	0.047	0.008	-0.001	0.045**	0.071**
EdSec_Oth	0.030	0.032	0.086***	0.055	0.090**	0.081
EdVoc_Oth	0.034	0.039	0.056*	0.043	0.087**	0.066
EdTer_Oth	-0.053	-0.066	0.107**	0.107*	0.135***	0.137**
Prop6	0.035	0.113	-0.013	0.028	0.033	-0.007
Prop715	-0.062	-0.084	-0.001	0.010	-0.018	-0.025
Prop60	-0.044	-0.027	-0.069**	-0.065*	-0.115***	-0.117***
HHsize	0.023***	0.021***	0.012***	0.010	0.021***	0.032***
Urban	-0.007		0.002		-0.003	
Sample	2462	1644	2323	1556	2633	1756
Pseudo-R^2	0.074	0.082	0.088	0.052	0.113	0.112

Discussion and Conclusions

We outline a method to infer informal sector activity using income and expenditure surveys. We apply this method to the case of Bulgaria before and after a significant economic reform and investigate the effects of economic crisis on informal sector activity. We find that the informal sector acts, in part, as a buffer for households during periods of crisis when formal sector employment opportunities are limited. In this sense the presence of an informal sector provides a "safety net" and is welfare improving.

The method we employ uses household information about income and expenditure to allocate individuals to the informal sector. We argue that households that spend considerably more than their total income must be getting income from informal

sources. In this context total income is defined to be the sum of labor income, transfers, and the change in asset position. If after accounting for all of these sources of income there is still a large difference in announced income and announced expenditure then we argue that the household is participating in the informal sector.

The Bulgarian income and expenditure survey is particularly useful for this purpose in that all sources of income are accounted for including transfers from the State and from private individuals outside of the household, and the running down of personal financial assets such as savings or physical assets such as livestock or vegetables grown at household owned plots. As a check on our method we examine the income and expenditures of households that we strongly believe do not participate in the informal sector. These are households where all working-age individuals are working full-time jobs in either the public or private sectors. In both years of our sample we find that for these households the ratio of reported income and reported expenditure is almost identical to 1. Given this result we then assign households to informal sector activities if their reported expenditures are greater than 1.5 times their reported income. As a robustness check we also report results for when the threshold for informal sector activity is set at 1, 2, and 3 respectively. We find that, apart from there being a difference in the overall size of informal sector activity, our results are quite robust to this definition. We think a threshold of 1.5 is a conservative threshold that allows for measurement errors in income and expenditure to not greatly affect our allocation of households into informal sector activity.

The main objective of this research proposal is therefore to develop a deterministic method to determine whether households (or individuals) are participating in the informal sector. Once we are able to do this then we can exploit the other information that is available for these households (or individuals) in the data in formal econometric models. These models can be used to answer questions about the role that the informal sector plays in the economy as well as gaining insight into what are the important determinants of a household's (or individual's) involvement in the informal sector. With this method we will be able to repeat this study across many different and diverse countries which would allow us to better understand what characteristics of the informal sector are common and which characteristics are country specific. It is our belief

that before any general policy can be recommended there first needs to be a determination of exactly what characteristics are common across countries.

Once we have this method we will be able to ask a number of different questions about the informal sector. Examples of questions that interest us include the determinants of mobility into and out of the informal sector (e.g. are there any differences in mobility during periods of economic stress), are there any gender differences in the decision to participate in the informal sector, and whether the decision is an individual decision or a decision made at the household level. We hope to be able to get a much clearer understanding of the role the informal sector plays in the overall economy and therefore hope to better understand the role that economic policy has on the informal sector.

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