Marshall and Labour Demand in Russia: Going Back to Basics

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William Davidson Working Paper Number 392
August 2001

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This version: August 2001

Keywords: Labour Demand, rules of derived demand, enterprise performance, transition to a market economy

JEL Classification: J20, J23, M51, P31

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[1] The authors are grateful to Frederic Warzynski for research assistance and to Tatyana Gorbacheva, Douglas Lippoldt, Stefan Lutz, Andrew Newell, Mark Schaffer, Christoph Schmidt and Ruslan Yemtsov and participants of the CEPR/ESRC workshop in June 1999 at Sussex University, of an IZA workshop in February 2000 in Bonn, of an EERC-IZA workshop in Kiev and of the CEPR-WDI conference in Portoroz, Slovenia in 2001 for valuable comments. We also thank the Fritz Thyssen Foundation for financial support within the project "Economic Reform and the Microeconomics of Labour Market Adjustment in the Russian Federation".

Abstract

Using a unique enterprise-level data set, which covers the regions Moscow City, Chelyabinsk, Krasnoyarsk and Chuvashia and the three sectors manufacturing and mining, construction and trade and distribution, we estimate Russian labour demand equations for the year 1997. The most important conclusion that can be drawn is that labour demand is inelastic in international perspective if we estimate a labour demand equation for all regions and all sectors combined. So, Russian MLEs well into the transition still exhibit peculiar behaviour as far as wage employment trade-offs are concerned. We try to relate this inelastic labour demand to basic neoclassical theory by testing Marshall's rules of derived demand. Our results show that testing these rules seems a promising avenue for establishing some of the driving forces, which are behind labour demand in Russia.

I. Introduction

The transition process to a market economy has been extremely difficult in the Russian Federation. Figure 1 shows a collapse of GDP of almost 50% in less than 10 years, with no signs of recovery by 1999. Assuming an annual average growth rate of 3% would imply that it takes 25 years before Russia would reach a GDP level comparable to the pre-transition level of GDP. In contrast, the collapse in employment has been much more moderate. Figure 2 shows a collapse in employment of only 15% over a 10 year period, while average real producer wages collapsed to 30% of their initial level in 1991 (Figure 3). The relationship between the evolution of employment, output and real wages is not well understood. The purpose of this paper is to use micro data to analyse labour demand in the Russian Federation and to point out factors that explain the relationship between wages, output and employment adjustment.

Most of the studies on labour market adjustment in Russia that use micro data have focused on responses of *workers* to transition or have used household data to get at firm behaviour.[1] But little is known about the actual employment adjustment of *firms* in response to output shocks and changes in wages. There are three papers that study employment adjustment of firms in the context of gross job flows. Konings and Walsh (1999) and Richter and Schaffer (1997) both use firm level surveys to study gross job creation and destruction in 'de novo' and traditional firms and find that 'de novo' firms have higher job creation rates, but also higher job destruction rates. Both papers estimate

[1] See for example Newell and Reilly (1996), Foley (1997), Lehmann and Wadsworth (2000), Earle and Sabirianova (1998) and Lehmann, Wadsworth and Acquisti (1999).

for Russia a gross job reallocation rate of 9%. Acquisti and Lehmann (1999), using census-type data for four Russian regions, estimate this rate in 1997 to be 13%, 19% and 22% for large and medium firms in manufacturing, construction and trade respectively and to be 76% for small firms in these three sectors, falling to 34% in the case of continuing firms. In the case of continuing firms the overall picture clearly shows that job destruction dominates job creation. None of these papers looks at the relationship between employment adjustment and wages and output. Basu, Estrin and Svejnar (1999) look at labour demand in transition countries, including Russia, but the latter country is not in the centre of their analysis.

This paper is to our knowledge the first study that uses a large firm level data set to estimate labour demand of state-owned, privatised firms and of firms with mixed ownership in the Russian Federation.[2] As noted by Blanchard (1997), one of the key issues to investigate is whether firms continued to hoard labour and to what extent downward wage adjustment occurred. One could expect that with collapsing output workers are willing to take wage cuts to preserve their jobs. Thus, one can expect a trade-off between wages and employment and so it will be of particular interest to investigate wage elasticities. In addition, if state firms keep operation under soft-budget constraints one would expect labour hoarding to continue. Much of the empirical literature on firm adjustment in the early years of transition shows little difference in the behaviour of state-owned and privatised firms. Five years into transition one might wonder whether and how Russian privatised firms differ in their employment decisions from their state-owned counterparts. We will touch upon these issues in this paper and hope therefore to provide insights into the nature of the trade off between wages and employment at the firm level in Russia. In this context, we will try to relate observed data to basic neoclassical theory by using and testing three of Marshall's rules of derived demand (cf. Hamermesh, 1993, and Hicks, 1968) and by looking in addition at the elasticity of labour supply, which feeds into the capability of the economy to adjust employment. The estimation of the elasticity of labour supply also serves as a substitute for testing Marshall's fourth rule of derived demand that relates labour demand to the supply elasticities of other factors of production.

Our research uses two main data sources. We use census-type micro data of more than 4800 state-owned, privatised and mixed firms in four representative regions of the Russian Federation[3] to estimate labour demand equations. In addition, we will make use of micro data from the Russian Labour Force Survey (RLFS) of November 1997 and a supplement to this survey that contains wage data to see how elastic labour supply is in Russia. The RLFS data at our disposal cover the same regions.

The next section discusses the data set that we use to estimate labour demand. Section III gives some theoretical background and discusses Marshall's rules of derived demand. Section IV reports results for various specifications and sub-samples that we consider. Section V tests three of Marshall's rules and hence attempts to provide a partial interpretation of the wage elasticities that we estimate. In this section we also estimate wage elasticities from the supply side. The conclusions are given in section VI.

II. Data

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[2] Luke and Schaffer (1999) test wage determination models in Russia employing the same data set.
[3] These regions are Moscow City, Chelyabinsk, Chuvashia and Krasnoyarsk. These regions are representative of certain labour market types in the Russian Federation (cf. Lehmann, Gontmakher and Starodubrovskiy (1999).

The research is based on end-year 1996 and 1997 data sets for “medium-sized and large” enterprises (MLEs) in the four above-mentioned regions. The data on MLEs are census-type data that go back to Soviet times. In the Soviet Union virtually all state-owned enterprises were of medium or large size and had to report certain statistics to Goskomstat on a quarterly or annual basis. After the beginning of the reforms Goskomstat sent modified questionnaires to the same firms accommodating the need for different information in a changed economic environment. Small firms, which hardly existed in the Soviet Union but had been created in large numbers after the economic regime switch, were not covered by any official data collection. Consequently, starting in 1994 Goskomstat has been sending a questionnaire designed for “small firms” (“malye predpriyatiye”) to a random sample of such firms in each administrative region of the Russian Federation. In our assessment, data on MLEs refer, therefore, above all to enterprises that have already existed under central planning and that have continued their activities during transition, while data on “small firms” refer for the most part to firms that have been born after January 1992. Labour demand of the latter firms is not investigated in this paper.

The characterisation of MLEs as enterprises continuing from Soviet times has an important implication. The MLEs come in three ownership categories; they are labelled “state-owned”, “private” and “mixed”. The vast majority of MLEs that are labelled “private” in our data can be considered privatised firms, while those labelled “mixed” refer to partially privatised enterprises where private capital is domestically owned and the state still has a stake in the firm. So, de novo private firms are virtually absent in the used data set.

The data cover three industries: manufacturing and mining, construction and distribution and trade. They make up the lion share of employment in the non-budgetary sector of the Russian economy well into the transition and most restructuring in the Russian economy is taking place in these three industries (Gimpelson and Lippoldt, 2000). So, by choosing manufacturing and mining, construction and distribution and trade we hope to capture some general patterns of labour demand in Russia.[4]

Our data set is very rich, containing many variables on employment, variables on sales, labour costs and material costs as well as variables on balance sheet items. A synoptic description of the data set is provided in the appendix. Those variables that are particularly interesting in connection with the estimation of labour demand equations are presented in Table 1. Average employment is largest in mixed firms, smallest in state-owned firms, while the average real wage is lowest in privatised firms and highest in mixed firms.[5] Both real output and employment have been falling substantially in 1997, but the decline in employment has been lower on average than the decline in output. Some interesting differences across ownership types can also be observed. The contraction in real output is nearly twice as large in privatised compared to state-owned firms. The fall in employment is also lowest in state-owned firms while mixed enterprises have roughly the same employment growth of –11% as have privatised firms even though their real output contraction is on average smaller by 5 percentage points.

[4] MLEs are officially defined by the Russian Statistical Office (Goskomstat) as those firms employing over 100 employees in manufacturing and mining, construction or transportation, and over 50 employees in the wholesale trade or over 30 in the retail trade. Inspection of the data set shows, however, that the average

Real wages on the other hand seem quite stable over the year, so on this evidence there seems to have been little downward wage flexibility in 1997. This is consistent with what has been observed in aggregate data. From figure 3 we can indeed notice that real wages in 1997 did not change very much.

III. Labour Demand and Marshall's Rules

One way to derive labour demand is based on cost minimisation. If total costs are assumed to be the sum of products of the profit-maximising input demands and factor prices and if total costs are assumed to be linearly homogeneous in the latter, then the total cost function can be written as

$$C = C(w, r, m, Q). \qquad (1)$$

Where C are total costs, w the real wage, r the real user cost of capital, m the real unit material cost and Q real output. Using Shepard's lemma, $N^* = C_w$ (2), where N^* is the cost-minimising demand for the input labour and C_w is the partial derivative of the total cost function with respect to labour[6]. Equation (2) can be written as

$$N^* = N^d(w, r, m, Q), \qquad (3)$$

annual employment of quite a few MLEs falls below the cited lower bounds. This is another reason why one might want to characterise MLEs as firms existing already before transition.

[5] To deflate nominal values we take 1995 as a base year.

[6] This function is also consistent with models of imperfect competition in the product market. We should also point out that we are not so myopic to assume that Russian firms are true profit maximizers or cost minimizers. We choose the used derivation as a convenient device to generate an estimable labour demand function that relates employment to wages and output.

Log-linearising (3) one gets an easily estimable equation that yields the constant-output own price elasticity of demand for labour, λ_{NN}, the cross-elasticities of labour demand, λ_{NK} and λ_{NM}, as well as the employment-output elasticity, where K stands for capital and M for materials here. A very general specification of labour demand, which assumes that all unit factor prices are available and which allows for some dynamics, then can take the following estimable form of (3):

$$n_{it} = \boldsymbol{\delta}_i' + \gamma n_{i,t-1} + \beta_1 w_{it} + \beta_2 r_{it} + \beta_3 m_{it} + \beta_4 q_{it} + \varepsilon_{it}\,, \qquad (4)$$

where all variables are now in logs, ε_{it} is a white noise error term and $\boldsymbol{\delta}$ is a vector containing unobservable regional, sector and ownership specific effects, which we capture with regional, sector and ownership dummies. The subscripts denote firm i at time t. Estimating equation (4) in its full version is in most cases not feasible as information on user cost of capital and unit material cost are not readily available at the firm level. In our case we try to control for r and m with regional, sector and ownership dummies. The equation, with which we estimate labour demand using the entire data set, becomes therefore:

$$n_{it} = \boldsymbol{\delta}_i' + \gamma n_{i,t-1} + \beta_1 w_{it} + \beta_2 q_{it} + \varepsilon_{it}\,. \qquad (5)$$

While we estimate (5), using OLS, we also employ IV estimation to avoid potential endogeneity problems. For real wages and real output, lagged values of real wages and output turn out to be feasible and good instruments.

We take a close look at Marshall's rules of derived demand in order to understand better what might drive the real wage elasticity estimates of labour demand in Russia. Marshall's rules are valid when the economy is in equilibrium, i.e. in the long run. We understand "long run" in connection with equation (5) as a steady state, which implies that we equate n_{it} and $n_{i,t-1}$ so that the relevant long run coefficients become $\beta_1/(1 - \gamma)$ and $\beta_2/ (1 - \gamma)$.[7] Equation (5) gives the conditional demand for labour or the constant output demand for labour, while Marshall's rules are related to the unconditional demand for labour, when output is allowed to vary. To estimate an unconditional demand function for labour, however, requires to endogenise the output decision, whish from a theoretical point of view is done by substituting the output for the output supply function of the firm, which requires information on prices and supply. Such data, however, are not available. However, apart from considering the OLS results of the conditional demand function for labour we also consider to instrument output in the labour demand function that we estimate.

The four rules of derived demand can be synoptically summarised as follows (Hamermesh, Chapter 2; Hicks, 1968):

[7] Since we do not control for capital and material inputs in regression (5) one could also think of β_1 and β_2 as long-run coefficients.

1/ Ceteris paribus, the lower the labour share in total revenue, the lower the own wage elasticity.

2/ Given the labour share in total revenue, the lower the substitution elasticity, the lower the own price elasticity.

3/ Labour demand is less elastic when the demand for the product is less elastic.

4/ Labour demand is less elastic, the less elastic is the supply of other factors of production.

Labour shares can easily be estimated with our data as we can readily compute sales and the wage bill in real terms. To arrive at an estimate of the elasticity of substitution between labour and capital and labour and material respectively, we estimate two-input translog production functions, where we fix either materials or capital. We then recover from the coefficient estimates the two elasticities of substitution.

The estimation of product demand is somewhat less straightforward. Our strategy is to produce estimates of the "Lerner Index", i.e. estimates of the price cost margin, which is equivalent to the inverse of the product demand elasticity. Our methodology is based on Hall (1986), Domowitz et al. (1988) and Roeger (1995). We start from a standard production function $Q_{it} = \Theta_{it} F(N_{it}, K_{it}, M_{it})$, where i is a firm index for the firm, t is a time index, Θ is the level of productivity, N is labour, K is capital and M is material input.

Under perfect competition, it is well known since Solow that the growth rate of output can be decomposed as follows:

$$\frac{\Delta Q_{it}}{Q_{it}} = \alpha_{Nit} \frac{\Delta N_{it}}{N_{it}} + \alpha_{Kit} \frac{\Delta K_{it}}{K_{it}} + \alpha_{Mit} \frac{\Delta M_{it}}{M_{it}} + \vartheta_{it} \qquad (6)$$

where $\alpha_{Jit} = \frac{P_{Jit} J_{it}}{P_{it} Q_{it}}$ (J=N,K,M) is the share of inputs in turnover and $\vartheta_{it} = \frac{\Delta \Theta_{it}}{\Theta_{it}}$.

Under imperfect competition. Eq. (6) becomes (Hall, 1986):

$$\frac{\Delta Q_{it}}{Q_{it}} = \mu_{it} \left(\alpha_{Nit} \frac{\Delta N_{it}}{N_{it}} + \alpha_{Kit} \frac{\Delta K_{it}}{K_{it}} + \alpha_{Mit} \frac{\Delta M_{it}}{M_{it}} \right) + \vartheta_{it} \qquad (7)$$

where $\mu = \frac{p}{c}$ is the markup of price over marginal cost.

Another way to write it is:

$$\frac{\Delta Q_{it}}{Q_{it}} - \alpha_{Nit} \frac{\Delta N_{it}}{N_{it}} - \alpha_{Mit} \frac{\Delta M_{it}}{M_{it}} - (1 - \alpha_{Nit} - \alpha_{Mit}) \frac{\Delta K_{it}}{K_{it}} = \beta_{it} \left(\frac{\Delta Q_{it}}{Q_{it}} - \frac{\Delta K_{it}}{K_{it}} \right) + (1 - \beta_{it}) \vartheta_{it} \quad (8)$$

where $\beta = \frac{p - c}{p} = 1 - \frac{1}{\mu}$ is the Lerner index.

It is also possible to derive a similar expression for the price based, or dual, Solow residual (Roeger, 1995):

(9)

$$\alpha_{Nit} \frac{\Delta P_{Nit}}{P_{Nit}} + + \alpha_{Mit} \frac{\Delta P_{Mit}}{P_{Mit}} + (1 - \alpha_{Nit} - \alpha_{Mit}) \frac{\Delta P_{Kit}}{P_{Kit}} - \frac{\Delta P_{it}}{P_{it}} = -\beta_{it} \left(\frac{\Delta P_{it}}{P_{it}} - \frac{\Delta P_{Kit}}{P_{Kit}} \right) + (1 - \beta_{it}) \vartheta_{it}$$

Then substracting (9) from (8):

(10)

$$\left(\frac{\Delta Q_{it}}{Q_{it}}+\frac{\Delta P_{it}}{P_{it}}\right)-\alpha_{Nit}\left(\frac{\Delta N_{it}}{N_{it}}+\frac{\Delta P_{Nit}}{P_{Nit}}\right)-\alpha_{Mit}\left(\frac{\Delta M_{it}}{M_{it}}+\frac{\Delta P_{Mit}}{P_{Mit}}\right)-\left(1-\alpha_{Nit}-\alpha_{Mit}\right)\left(\frac{\Delta K_{it}}{K_{it}}+\frac{\Delta P_{Kit}}{P_{Kit}}\right)$$
$$=\beta_{it}\left[\left(\frac{\Delta Q_{it}}{Q_{it}}+\frac{\Delta P_{it}}{P_{it}}\right)-\left(\frac{\Delta K_{it}}{K_{it}}+\frac{\Delta P_{Kit}}{P_{Kit}}\right)\right]+\varepsilon_{it}$$

Rewriting the left hand side as Δy and the right hand side as Δx, one obtains a very simple testable equation: $\Delta y_{it}=\beta_t \Delta x_{it}+\varepsilon_{it}$, where we have have imposed the same coefficient for all firms. We shall use Eq. (10) to estimate the Lerner index or the inverse of the product demand elasticity. This methodology allows us to use nominal values of the variables and the Lerner index can be estimated consistently using OLS (Roeger, 1995). The methodology is similar to Levinsohn (1993) and Konings et al. (2001).

IV. Results: Labour Demand

Tables 2 – 5 report estimated labour demand equations for the total data set of MLEs and for various sub-samples. Below the coefficients the standard errors are shown in parentheses. In virtually all cases we give the results of both OLS and IV estimation, where the variables of interest are highly significant throughout. The wage elasticity for the entire data set (Table 2) is roughly 0.06 in absolute value if we use the IV estimates and the "long run" wage elasticity is about 0.26. This estimate is low by international standards; wage elasticities that are estimated from micro data in the many western studies on labour demand are seldom less than 0.45 in absolute value (Hamermesh, 1993, chapter 3). So, on this evidence there is little trade-off between wages and employment in Russia. The employment-output elasticity is also low by international standards. This can be taken as evidence that labour hoarding might still be a problem, possible due to the presence of soft budget constraints. The interpretation of labour hoarding that is associated with low output elasticities is also given in Estrin and Svejnar (1997) who estimate labour demand functions for Central and East European Countries. They find that at the start of transition wage and output elasticities are very low, however, once transition progresses these elasticities also increase.

Looking at the results for the overall sample in Table 2 and thinking of a steady state long run we get a unitary long run employment-output elasticity - the estimate of $\beta_2/(1 - \gamma)$ is roughly one. This would imply a CES production function underlying the labour demand equation. So we estimated a labour demand equation imposing the restrictions that mirror a CES production technology. The results (not shown) again give us a very low own wage elasticity of labour demand, i.e. an elasticity of -0.07, which given the assumption of a CES production technology is exactly the same as the substitution elasticity between labour and capital.

The result of inelastic labour demand in Russia is not altered when we disaggregate the data by ownership (Table 3). Taking the IV estimates of the labour demand equations, all ownership types have low wage and output elasticities. It is noteworthy that privatised firms have a particularly weak wage-employment trade-off, while the steady state employment-output elasticities are roughly equal across ownership categories.

When we estimate labour demand separately for regions we do see some substantial differences, though (Table 4). Calculating steady state values, Chuvashia has a wage elasticity that is roughly three and a half times larger in absolute value than the wage elasticities of Moscow and Krasnoyarsk and slightly less than double the wage elasticity in Chelyabinsk. The employment-output elasticities, on the other hand, show little variation across regions, with a spread of 15 percentage points between the highest value in Chelyabinsk (0.91) and the lowest value in Chuvashia (0.76). The estimated wage elasticities by sector show some differences between trade and the other two sectors. The long run wage elasticity in trade (-0.57) is in absolute value larger by 12 percentage points than the wage elasticity in manufacturing, while the employment-wage elasticity is virtually zero in the case of construction. The more elastic labour demand in the trade sector is a result that one might expect, as this sector should be more competitive than manufacturing.

Summarising the results on estimates of wage and employment elasticities one should stress that in general these elasticities are very low hinting at a weak link between movements in wages and output on the one hand and movements in employment on the other hand. Whether neoclassical theory can shed some light on this outcome will be discussed in the next section where we test Marshall’s rules of derived demand.

V. Results: Testing Marshall’s Rules

We first look at the calculated average labour shares for the overall data set and the various sub-samples that we previously discussed (Table 6). Labour shares are defined as the wage bill divided by total output. For the sample as a whole the average share is 24%, which is relatively high by western standards. For example, in Belgium this share has been estimated to be about 12%. This suggests that compared to a Western

Economy, such as Belgium, we would expect the wage elasticity to be higher in absolute value in Russia, given the relative high labour share. Wage elasticities using firm level data have been estimated for Belgium. Konings and Roodhooft (1997) estimate a short run wage elasticity of -0.60 and a long run of –1.2 for Belgian firms on average. Of course the relatively high labour share in Russia may be an artifact of rapidly collapsing sales, while such collapses do not occur in Western firms. So, in addition to performing cross-country comparisons we also look at differences in the labour shares within our Russian sample. Table 6 shows the average labour shares and the short run and long run wage elasticities. Across ownership types and regions Marshall's first rule seems to be borne out by the data albeit only in a rough manner. Firms in private ownership and in Moscow region have substantially lower average labour shares and also lower short and long run wage elasticities. However, we find a pattern that is clearly inconsistent with Marshall's first rule for the three sectors.

The estimates of the Lerner Index are given in Table 7. The estimate of 0.45 for the Lerner index for the overall sample implies an elasticity of product demand equal to 2.2. To set this into international perspective, using firm level data Konings, Van Cayseele and Warzynski (2001) estimate a product demand elasticity of 4.5 for Belgium and of 2.9 for the Netherlands, which is known to have an economy with one of the most developed cartel structures. So our estimate of product demand in the four Russian regions, hinting at strongly monopolistic product market structures, implies that inelastic product demand contributes to the low labour demand elasticity. When we compare the pattern of the Lerner index according to sectors within regions in Russia, however, we notice that the Lerner index in the 'Trade' sector is much higher than the Lerner index in

'Manufacturing' and 'Construction'. The fact that mark-ups are higher in the non-manufacturing sector is also found for Western countries (Small, 1997). The high Lerner index in the 'Trade' sector suggests that imperfect competition cannot serve as an explanation for differences between labour demand elasticities across sectors in Russia. However, as suggested by Brown and Earle (2000), competitive pressure in Russia has an important regional dimension, rather than a sectoral one. When we consider the Lerner index for the different regions then we can note that the regions with the higher Lerner index also are the regions with the lower labour demand elasticities[8]. So, this seems to confirm the predictions of Marshall's rule related to the product demand elasticity.

Table 8 give the estimates of the substitution elasticities of labour and capital and of labour and materials respectively. The elasticities are computed on the bases of estimates of translog production functions[9]. From table 8 it can be noted that they all are estimated close to zero, although the standard deviations are quite large[10]. So, there is very little substitution between inputs and Leontieff-type production functions seems to mirror the production process in these Russian firms quite well. This in line with some of the literature on labour market adjustment in Russia (e.g. Commander et al., 1995). Of course, these estimates also say that low substitutability between input factors contributes to the low wage elasticity of labour demand. It is interesting to note that the substitution elasticity for the trade sector between labour and capital is estimated higher on average

[8] We were not able to estimate the Lerner index for Krasnoyarsk since data on material costs were missing for that region.

[9] For the Krasnoyarsk region data on capital and material inputs were missing, so we do not report results for that region. We estimated two input translog production functions. In a previous version we used lagged values of the input factors to avoid a potential similateneity bias, but the results were very similar.

[10] The negative average substitution elasticities in most cases is mainly due by the fact that the marginal product of capital is often estimated negative.

than for the other sectors. This is driven by some outliers in the data as suggested by the high standard deviation. Nevertheless it is consistent with finding a higher wage elasticity in the 'trade sector'.

The last contributing parameter that can be estimated is the elasticity of labour supply. Supply elasticities of capital and materials, which ideally should be estimated, can in general not be obtained because of data limitations. Our data set is no exception and we have to satisfy ourselves with estimates of labour supply elasticities, which is taken as a proxy for the elasticity of factors of production. Data from the Russian Labour Force Survey and from a complementary supplement, which includes wages and variables that might influence the decision to participate in the labour market are used for the estimation of labour supply equations. We employ the usual Heckman procedure to control for selectivity bias. The supplement to the RLFS gives us a rich enough set of variables for the probit equation that estimates the probability of participating in the labour market. For example, non-wage income, education, income from sale of home-grown produce, consumption of home-grown produce and number of events in a person's labour market biography since 1990 are some of the variables used in the probit regression.

The elasticities, estimated separately for males and females, are very low by international comparison, never exceeding 0.07 (see Table 9). In western economies the range of elasticity estimates do normally not fall below 0.1. So low labour supply elasticity, if taken as a proxy for the elasticity of other factors of production, seems to be a contributing factor to the low labour demand elasticity in Russia. In addition, given the very low labour supply elasticities a very low labour demand elasticity will generate comparative statics that are mirrored in the stylized facts of the Russian labour market, i.e. a fall in real wages that is proportionally larger than the fall in employment, where the latter is, however, substantial.

VI. Conclusions

In this paper we have used a unique enterprise-level data set, which covers the regions Moscow City, Chelyabinsk, Krasnoyarsk and Chuvashia and the three sectors manufacturing and mining, construction and trade and distribution, in order to estimate Russian labour demand equations for the year 1997. While the results are still tentative we can make some conclusions with confidence.

The most important conclusion that can be drawn is that labour demand is inelastic in international perspective if we estimate a labour demand equation for all regions and all sectors combined. So, Russian MLEs well into the transition still exhibit peculiar behaviour as far as wage employment trade-offs are concerned. This principal result is not altered when we disaggregate the data by ownership. However, there are some noteworthy differences across regions and sectors. In the Chuvash Republic labour demand is more elastic - with respect to wages, but not with respect to output - than in other regions. What reasons lie behind the fact that MLEs in Chuvashia seemingly respond more readily to wage changes by altering employment than do MLEs in other regions is the subject of future research. That the sector trade has a more elastic demand for labour comes as less of a surprise since one would consider this sector more competitive than manufacturing or construction.

What are the determining factors of the overall very inelastic labour demand? Testing Marshall's rules of derived demand for the whole sample and across various subsets of our sample we find that inelastic labour supply proxying for factor supply elasticity and very low elasticities of substitution between labour and other inputs are factors that unequivocally can explain a low elasticity of labour demand. Across the regional and ownership dimensions, labour shares show roughly the pattern that Marshall’s first rule would predict. In the case of product demand elasticities the results are less clear cut across the various dimensions of our sample. However, if we take the sample as a whole we do observe that relative to countries where cartels are very prominent players in the economy, Russian product markets seem to be characterised by low product demand elasticities.

While more work is certainly needed once more data points for our sample of MLEs in four regions become available, one can state that testing Marshall's rules of derived demand seems a promising avenue for establishing some of the driving forces, which are behind the inelastic labour demand in Russia.

Appendix

Synoptic description of Russian enterprise level data for MLEs

Description	Example
Information on employment for different points in time	Average listed employment for the last quarter of the reporting/previous year
Information on wage fund for different points in time	total wage fund from the beginning/previous year wage fund for listed employees
Social benefit payments for different points in time	
Information on working hours for different points in time	men-hours worked, number of employees working short-time/on unpaid leave etc.
Job creation, job destruction from the beginning of the year (employees without part-timers) / Expected for the next year	Total hirings/newly created jobs Total separations/layoffs Vacancies
Data on firm transactions, monthly	balance sheet, receivables, payables, working capital, stocks and expenditure
Data on production and transaction costs for reporting and previous year	production output, (prime) costs, material costs, wage costs, social contribution, production and transaction costs
Balance sheet for the beginning and end of the reporting year	fixed capital, assets, own funds, consumption funds, liabilities.

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Table 1: Summary statistics of Employment, Wages and Output.

	Obs.	Total Sample Mean (St. Deviation)	Obs.	State Firms Mean (St. Deviation)	Obs.	Privatised Firms Mean (St. Deviation)	Obs.	Mixed Firms Mean (St. Deviation)
Employment 1997	5211	306.5957 (1450.62)	1567	179.12 (653.76)	2145	201.29 (683.13)	1338	626.13 (2402.9)
Average wage 1997	5211	89.18 (89.641)	1567	93.38 (80.19)	2145	64.18 (81)	1338	132.82 (98.317)
Real Average Wage 1997	5211	49.27 (49.52)	1567	51.59 (44.3)	2145	35.46 (44.75)	1338	73.38 (54.31)
Output 1997	4235	30201.41 (237674.5)	1277	11590.48 (52937.02)	1704	15785.63 (59739.97)	1135	75660.74 (446699.2)
Real Output 1997	4235	16685 (131311.9)	1277	6403.5 (29246.9)	1704	8721.342 (33005.51)	1135	41801.52 (246795.1)
Change in Employment	5076	-0.103 (0.279)	1537	-0.082 (0.227)	2068	-0.116 (0.298)	1313	-0.112 (0.309)
Change in Real Wages	5065	-0.0163 (0.277)	1532	-0.0165 (0.267)	2066	-0.032 (0.289)	1309	0.005 (0.27)
Change in Real Output	4117	-0.141 (0.364)	1247	-0.105 (0.351)	1643	-0.182 (0.359)	1109	-0.135 (0.386)

Note: *Wages in 100000 of Rbl*
Output in millions of Rbl

Table 2: Labour Demand – Total Sample. Dependent variable *ln(N)*

	Total Sample OLS	Total Sample IV
Variable	Coefficient (St.Error)	Coefficient (St.Error)
Constant	-0.28 (0.22)	-0.272 (0.023)
Employment_1	0.77 (0.016)	0.77 (0.018)
Real Av. Wage	-0.075 (0.008)	-0.061 (0.009)
Real Output	0.1822 (0.0107)	0.173 (0.013)
Ownership		
Private		
State	0.035 (0.012)	0.028 (0.012)
Mixed	0.0065 (0.011)	-0.002 (0.011)
Sector		
Trade		
Metall	0.089 (0.0319)	0.08 (0.032)
Chem	0.142 (0.0311)	0.121 (0.029)
Machine	0.153 (0.0255)	0.135 (0.026)
Wood	0.132 (0.025)	0.117 (0.026)
Constr.-man.	0.053 (0.02)	0.044 (0.021)
Light	0.192 (0.028)	0.175 (0.029)
Food	0.0316 (0.019)	0.025 (0.019)
Medmbiol	0.078 (0.023)	0.063 (0.022)
F-power	-0.029 (0.03)	-0.03 (0.031)
Construction	0.091 (0.021)	0.079 (0.023)
Region		
Moskva		
Krasnoyarsk	0.096 (0.0124)	0.077 (0.013)
Chelyabinsk	0.138 (0.012)	0.125 (0.013)
Chuvashiya	0.098 (0.016)	0.083 (0.017)
	F-statistics=8348.60 R-squared=0.9687	F-statistics=8095.33 R-squared=0.9686

Table 3: Labour Demand by Ownership Type.
Dependent variable *ln(N)*.

	State OLS	State IV	Mixed OLS	Mixed IV	Private OLS	Private IV
Variable	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)
Constant	-0.27 (0.044)	-0.299 (0.055)	-0.256 (0.057)	-0.27 (0.051)	-0.305 (0.036)	-0.31 (0.04)
Employment_1	0.726 (0.035)	0.719 (0.039)	0.794 (0.023)	0.81 (0.025)	0.774 (0.027)	0.79 (0.032)
Real Av. Wage	-0.094 (0.017)	-0.08 (0.021)	-0.104 (0.025)	-0.07 (0.028)	-0.059 (0.011)	-0.04 (0.012)
Real Output	0.218 (0.023)	0.219 (0.028)	0.173 (0.019)	0.152 (0.021)	0.178 (0.017)	0.166 (0.022)
Sector						
Trade						
Metall	0.11 (0.055)	0.106 (0.057)	0.152 (0.066)	0.127 (0.068)	0.042 (0.043)	0.024 (0.044)
Chem	0.328 (0.084)	0.33 (0.09)	0.179 (0.069)	0.138 (0.069)	0.09 (0.045)	0.07 (0.042)
Machine	0.2 (0.048)	0.193 (0.05)	0.215 (0.069)	0.181 (0.071)	0.092 (0.035)	0.071 (0.035)
Wood	0.175 (0.044)	0.175 (0.046)	0.21 (0.071)	0.177 (0.073)	0.046 (0.039)	0.015 (0.04)
Constr.-man.	0.027 (0.049)	0.02 (0.05)	0.15 (0.065)	0.125 (0.067)	-0.003 (0.027)	-0.015 (0.027)
Light	0.256 (0.049)	0.251 (0.05)	0.225 (0.07)	0.19 (0.073)	0.127 (0.048)	0.104 (0.051)
Food	0.058 (0.031)	0.05 (0.031)	0.108 (0.06)	0.087 (0.062)	-0.013 (0.03)	-0.017 (0.031)
Medmbiol	0.124 (0.034)	0.11 (0.0355)	0.131 (0.064)	0.1 (0.06)	-0.035 (0.062)	-0.051 (0.061)
F-power	-0.085 (0.055)	-0.103 (0.064)	0.037 (0.052)	0.037 (0.053)	0.059 (0.055)	0.088 (0.061)
Construction	0.141 (0.045)	0.142 (0.047)	0.162 (0.068)	0.12 (0.072)	0.051 (0.029)	0.032 (0.03)
Region						
Moskva						
Krasnoyarsk	0.115 (0.023)	0.096 (0.027)	0.074 (0.021)	0.056 (0.022)	0.11 (0.025)	0.086 (0.029)
Chelyabinsk	0.193 (0.031)	0.187 (0.036)	0.086 (0.016)	0.09 (0.016)	0.146 (0.022)	0.125 (0.025)
Chuvashiya	0.126 (0.023)	0.116 (0.027)	0.059 (0.033)	0.059 (0.034)	0.165 (0.042)	0.142 (0.044)
	F-statistics= 2176.03 R-squared= 0.9611	F-statistics= 2168.23 R-squared= 0.9616	F-statistics= 1841.60 R-squared= 0.9675	F-statistics= 1817.94 R-squared= 0.9664	F-statistics= 4103.52 R-squared= 0.9581	F-statistics= 37.64 R-squared= 0.9592

Table 4: Labour Demand by Region.
Dependent variable *ln(N)*.

	Krasnoyarsk OLS	Krasnoyarsk IV	Moskva OLS	Moskva IV
Variable	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)
Constant	0.079 (0.11)	-0.199 (0.124)	-0.33 (0.028)	-0.317 (0.03)
Employment_1	0.8 (0.03)	0.868 (0.034)	0.824 (0.021)	0.843 (0.026)
Real Av. Wage	-0.151 (0.038)	-0.043 (0.042)	-0.057 (0.014)	-0.032 (0.019)
Real Output	0.179 (0.026)	0.115 (0.029)	0.152 (0.014)	0.132 (0.019)
Ownership				
Private				
State	0.079 (0.023)	0.065 (0.024)	0.03 (0.016)	0.029 (0.017)
Mixed	0.031 (0.025)	0.02 (0.025)	-0.0009 (0.015)	-0.0009 (0.015)
Sector				
Trade				
Metall	-0.054 (0.098)	-0.056 (0.105)	0.049 (0.052)	0.008 (0.056)
Chem	0.005 (0.046)	0.026 (0.043)	0.087 (0.042)	0.042 (0.048)
Machine	-0.018 (0.033)	-0.008 (0.035)	0.095 (0.045)	0.041 (0.051)
Wood	-0.005 (0.032)	0.006 (0.035)	0.031 (0.045)	-0.013 (0.051)
Constr.-man.	-0.062 (0.034)	-0.035 (0.035)	-0.013 (0.044)	-0.061 (0.051)
Light	-0.012 (0.034)	0.025 (0.038)	0.102 (0.048)	0.047 (0.057)
Food	-0.069 (0.036)	-0.028 (0.038)	0.03 (0.0345)	-0.004 (0.039)
Medmbiol	-0.094 (0.031)	-0.082 (0.033)	0.09 (0.044)	0.037 (0.052)
F-power	-0.057 (0.067)	-0.034 (0.067)	-0.047 (0.045)	-0.08 (0.05)
Construction	0.028 (0.089)	0.021 (0.092)	0.067 (0.043)	0.017 (0.053)
	F-statistics=2561 R-squared=0.9861	F-statistics=35173 R-squared=0.09851	F-statistics=6122.3 R-squared=0.97	F-statistics=6179 R-squared=0.9712

Table 4 ***(Cont.)***

	Chelyabinsk OLS	Chelyabinsk IV	Chuvashiya OLS	Chuvashiya IV
Variable	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)
constant	-0.024 (0.089)	-0.155 (0.11)	1.04 (0.149)	0.972 (0.160)
Employment_1	0.783 (0.024)	0.822 (0.031)	0.366 (0.043)	0.401 (0.046)
Real Av. Wage	-0.141 (0.032)	-0.077 (0.038)	-0.483 (0.058)	-0.432 (0.063)
Real Output	0.205 (0.022)	0.164 (0.028)	0.505 (0.038)	0.462 (0.041)
Ownership				
Private				
State	0.067 (0.019)	0.066 (0.02)	-0.084 (0.043)	-0.091 (0.044)
Mixed	0.006 (0.016)	0.004 (0.016)	-0.021 (0.044)	-0.023 (0.046)
Sector				
Trade				
Metall	-0.121 (0.044)	-0.091 (0.044)	-0.11 (0.05)	-0.084 (0.041)
Chem	-0.136 (0.047)	-0.11 (0.051)	0.029 (0.115)	0.089 (0.12)
Machine	-0.053 (0.027)	-0.038 (0.028)	0.117 (0.051)	0.166 (0.053)
Wood	-0.046 (0.033)	-0.033 (0.033)	0.05 (0.064)	0.094 (0.067)
Constr.-man.	-0.102 (0.028)	-0.078 (0.031)	-0.01 (0.06)	0.041 (0.06)
Light	0.032 (0.031)	0.046 (0.03)	0.178 (0.053)	0.207 (0.055)
Food	-0.146 (0.035)	-0.121 (0.041)	-0.275 (0.062)	-0.207 (0.064)
Medmbiol	-0.107 (0.045)	-0.07 (0.048)	-0.122 (0.05)	-0.095 (0.047)
F-power	-0.171 (0.082)	-0.123 (0.073)	-0.421 (0.118)	-0.336 (0.113)
Construction	-0.065 (0.024)	-0.059 (0.027)	-0.083 (0.063)	-0.038 (0.061)
	F-statistics=3243.44 R-squared=0.9864	F-statistics=61036 R-squared=0.9856	F-statistics=784.14 R-squared=0.9856	F-statistics=9006.79 R-squared=0.9572

Table 5: Labour Demand by Sector.
Dependent variable *ln(N)*.

	Construction OLS	Construction IV	Manufacturing OLS	Manufacturing IV	Trade OLS	Trade IV
Variable	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)	Coefficient (St.Error)
constant	-0.254 (0.107)	-0.409 (0.109)	-0.076 (0.054)	-0.115 (0.057)	-0.301 (0.047)	-0.525 (0.069)
Employment_1	0.816 (0.028)	0.903 (0.024)	0.843 (0.017)	0.85 (0.019)	0.63 (0.032)	0.534 (0.043)
Real Av. Wage	-0.103 (0.036)	0.012 (0.033)	-0.085 (0.017)	-0.068 (0.021)	-0.175 (0.024)	-0.268 (0.038)
Real Output	0.181 (0.027)	0.085 (0.023)	0.131 (0.011)	0.1228 (0.014)	0.287 (0.024)	0.405 (0.04)
Ownership						
Private						
State	0.019 (0.027)	0.016 (0.027)	0.04 (0.016)	0.038 (0.016)	-0.001 (0.021)	0.003 (0.021)
Mixed	-0.01 (0.022)	-0.016 (0.023)	0.011 (0.012)	0.01 (0.011)	-0.063 (0.049)	-0.07 (0.047)
Region						
Moskva						
Krasnoyarsk	0.072 (0.072)	0.076 (0.079)	0.048 (0.012)	0.046 (0.012)	0.458 (0.064)	0.703 (0.101)
Chelyabinsk	0.048 (0.024)	0.067 (0.025)	0.066 (0.012)	0.067 (0.012)	0.501 (0.062)	0.773 (0.102)
Chuvashiya	0.026 (0.055)	0.069 (0.052)	0.1 (0.019)	0.107 (0.019)	0.371 (0.056)	0.659 (0.095)
	F-statistics= 2098.29 R-squared= 0.9603	F-statistics= 2117.6 R-squared= 0.9614	F-statistics= 9486.17 R-squared=0.9818	F-statistics= 9273.76 R-squared= 0.9816	Fstatistics= 1667.79 R-squared= 0.905	F-statistics =1447.16 R-squared= 0.896

Table 6: Average Wage Share in Turnover, Overall, by Sector, by Region and by Ownership Type

	Share	SR Elasticity	LR elasticity
Total Sample:	0.22	-0.061	-0.265
State Ownership	0.28	-0.08	-0.285
Mixed Ownership	0.25	-0.07	-0.368
Private Ownership	0.16	-0.04	-0.190
Krasnoyarsk	0.31	-0.043	-0.326
Moscow	0.16	-0.032	-0.204
Chelyabinsk	0.30	-0.077	-0.433
Chuvashiya	0.32	-0.432	-0.721
Construction	0.32	0	0
Manufacturing	0.24	-0.068	-0.453
Trade	0.16	-0.268	-0.575

Table 7: estimates of the Lerner index

Dep. Var.: Δy	**Roeger method (1995), OLS**	
	Coef.	**s.e.**
Δx	0.45^{***}	0.03
By sector		
Manufacturing	0.28^{***}	0.05
Trade	0.68^{***}	0.05
Construction	0.23^{***}	0.03
By region		
Moscow	0.50^{***}	0.05
Chelyabinsk	0.38^{***}	0.04
Chuvasha	0.30^{***}	0.05
By ownership		
State	0.51^{***}	0.06
Mixed	0.25^{***}	0.07
Private	0.53^{***}	0.06

Note: *, ** and *** denotes statistical significance respectively at 10 %, 5 % and 1 %

Table 8: average elasticity of substitution between labour and capital σ_{NK} and between labour and material σ_{NM}

	σ_{NK}		σ_{NM}	
	Average	st.dev.	average	st.dev.
By sector				
Manufacturing	-0.002	0.014	-0.001	0.02
Trade	0.015	0.79	-0.002	0.01
Construction	-0.001	0.003	-0.001	0.006
By region				
Moscow	-0.001	0.001	-0.001	0.006
Chelyabinsk	-0.001	0.003	-0.001	0.02
Chuvasha	-0.003	0.03	-0.02	0.23

Note: Estimates for Krasnoyarsk were not possible because of missing data on material and capital inputs.

Table 9: Tobit Estimation of Labour Supply Wage Elasticities

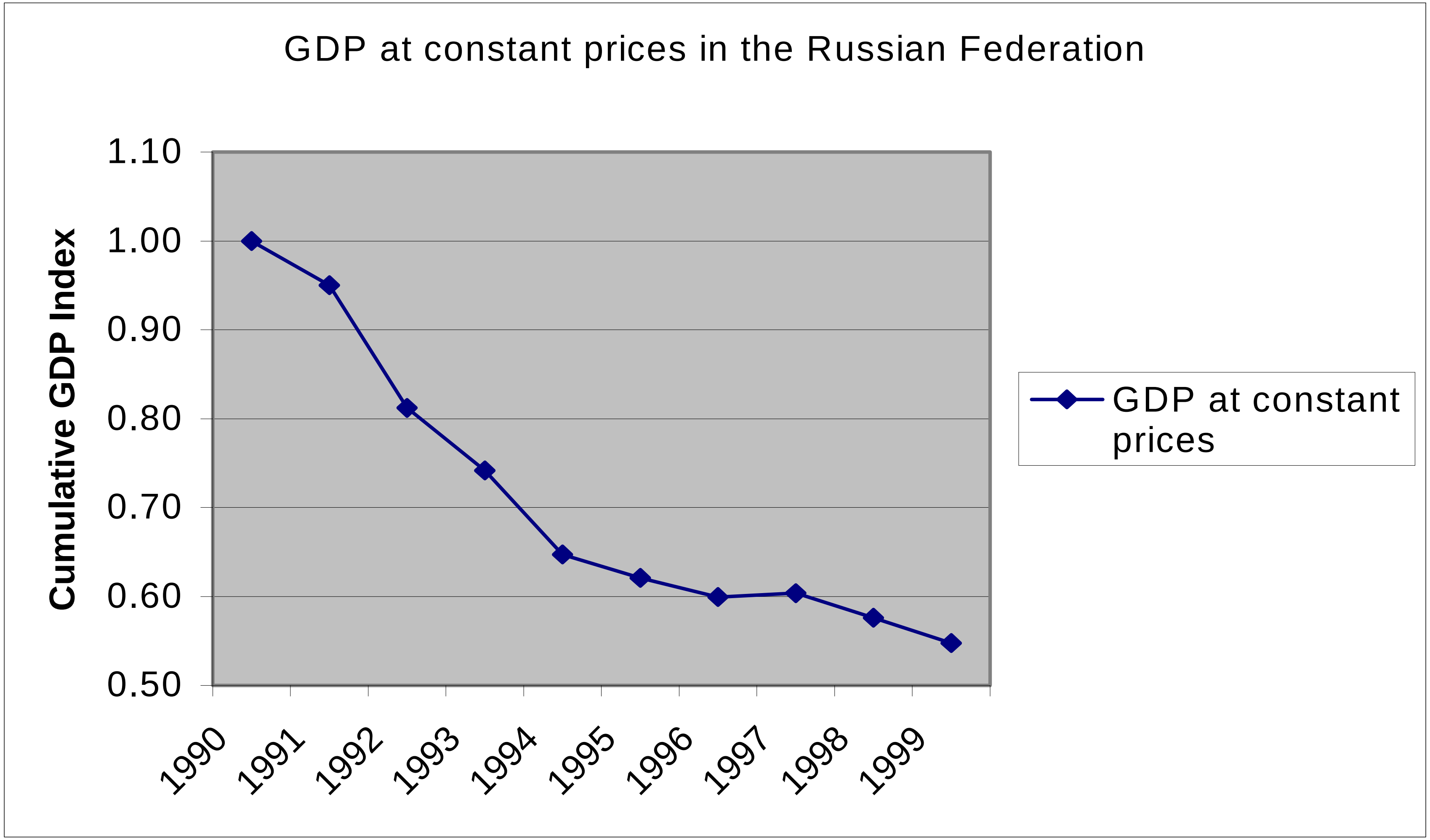
	Labour Supply Wage Elasticity Males	**Labour Supply Wage Elasticity Females**
Total sample	0.0260^{+} (8.981) 0.0261^{++} (9.002) λ=-0.01726 (0.00017)	0.0390^{+} (10.314) 0.0390^{++} (10.342) λ=-0.00602 (0.01357)
Moskva	0.0358^{+} (9.196) 0.0358^{++} (9.208) λ=-0.01727 (0.0022)	0.0478^{+} (10.432) 0.0467^{++} (10.353) λ=-0.04900 (0.00068)
Krasnoyarsk	0.0267^{+} (3.711) 0.0257^{++} (3.561) λ=-0.07576 (0.00177)	0.0161^{+} (1.991) 0.0160^{++} (1.991) λ=0.01530 (0.02682)
Chelyabinsk	0.0155^{+} (2.307) 0.0142^{++} (2.150) λ=0.01868 (0.01126)	0.0689^{+} (6.367) 0.0573^{++} (5.9876) λ=-0.07056 (0.00167)
Chuvashiya	0.0179^{+} (1.821) 0.0182^{++} (1.798) λ=-0.12768 (0.00605)	0.0414^{+} (2.530) 0.0386^{++} (2.387) λ=-0.04695 (0.00193)

Note: $^{+}$ *indicates estimates from Heckman two-step estimator and* $^{++}$ *stands for Tobit MLE with z-test statistics in parentheses.*

λ gives the product of the standard error of the residual in the regression equation and the correlation between the regression equation and the participation equation with standard errors in parentheses.

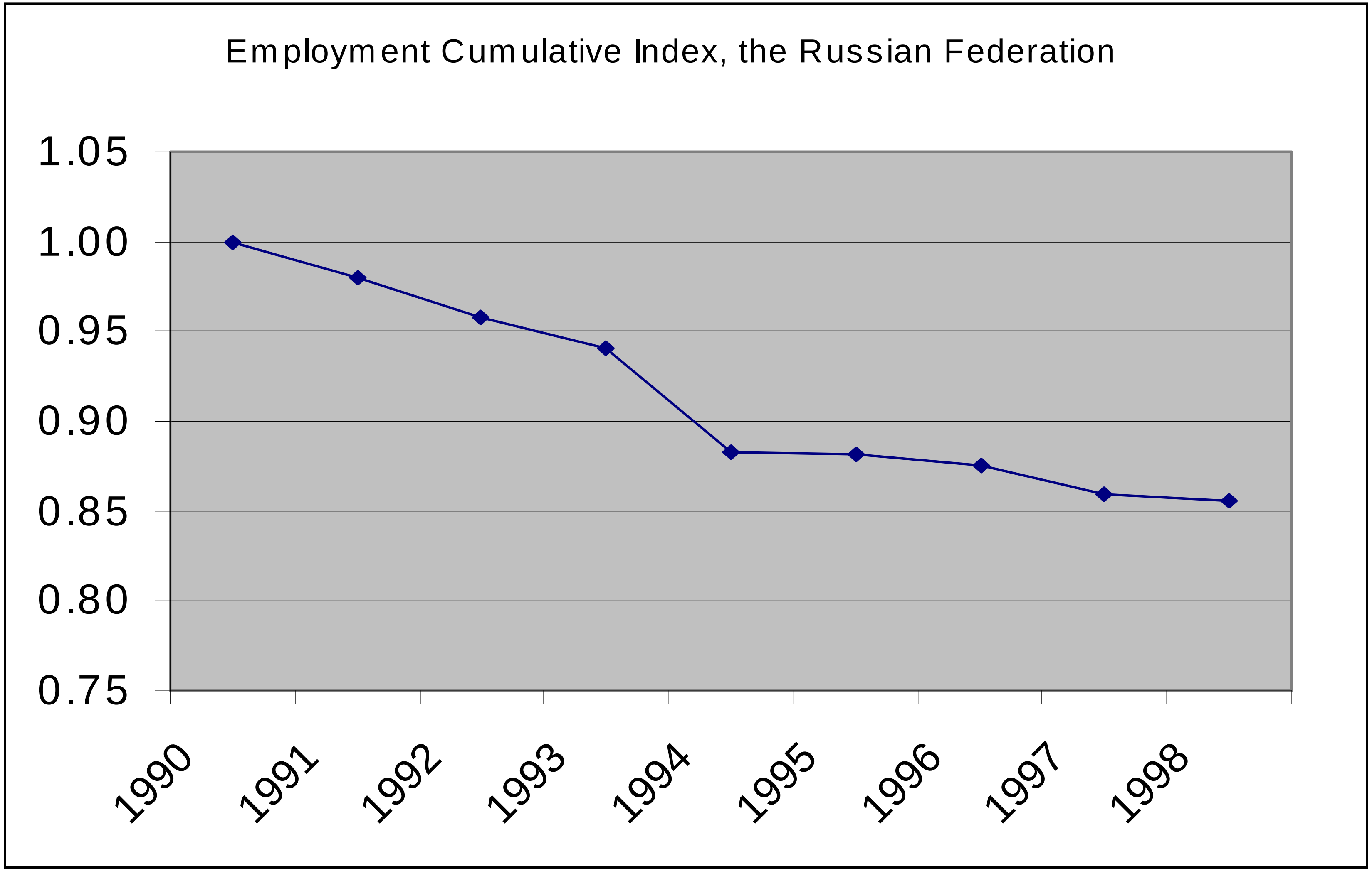
Source: Russian Labour Force Survey + Supplement (November 1997).

Figure 1



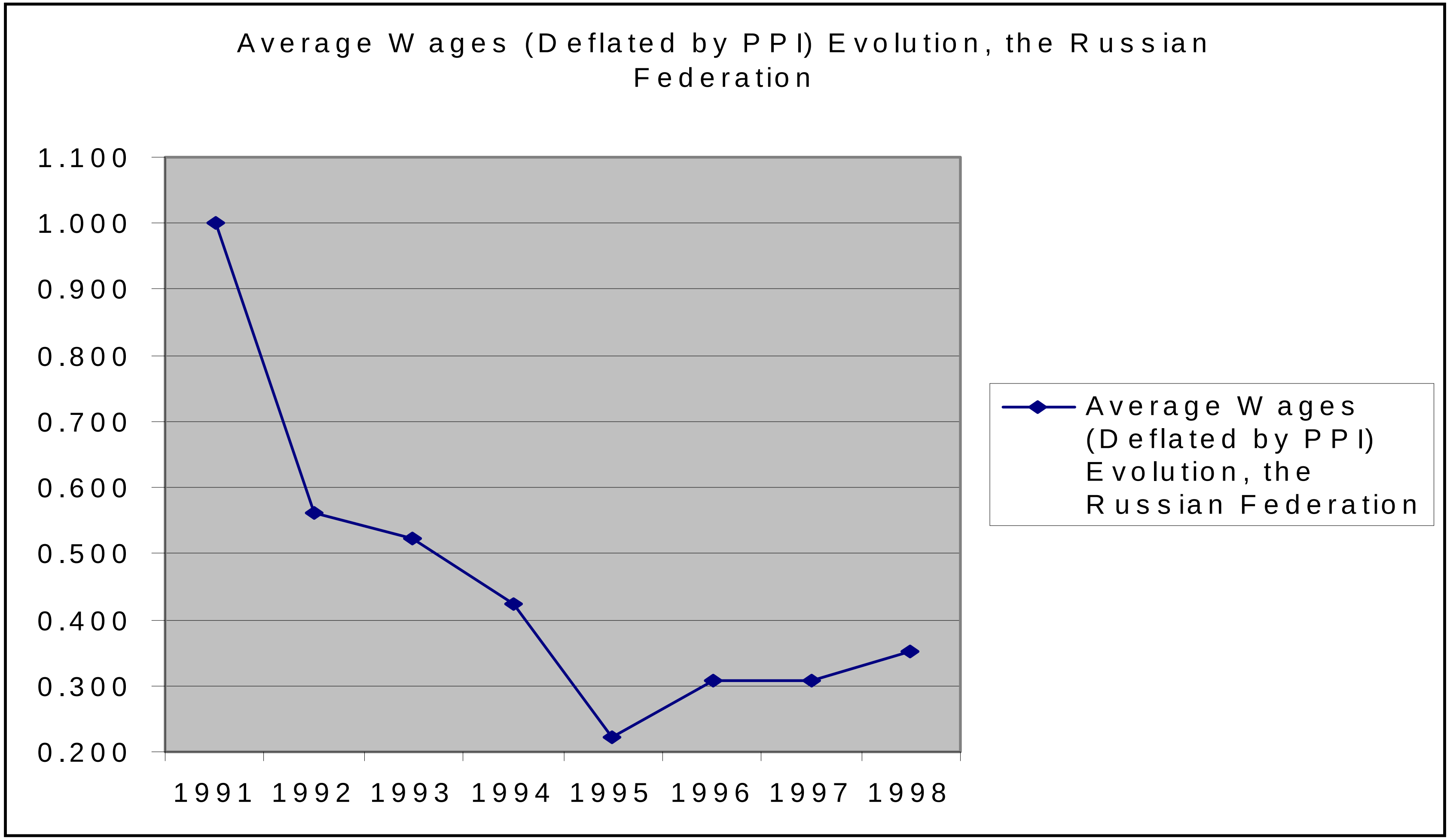
Source: Russian Economic Trends (2000)

Figure 2



Source: Russian Economic Trends (2000)

Figure 3



Source: Russian Economic Trends (2000)

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