Online Appendices for: Dark Matter: Measuring Unobserved Productivity Growth due to Computers through its Impact on Observables

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A. Behaviour of Concentrated Likelihoods

As noted in the paper, I address the issue of multiple local maxima for the multivariate-t likelihood by concentrating the likelihood using an iteratively reweighted least squares algorithm and find that the resultant likelihood surface is generally quite well behaved. This appendix illustrates this. In Tables A1 through A4 below I report the concentrated likelihood value for mismeasurement of computer & electronics intermediates using the specification given in (9) in the paper augmented with 0 to 3 lags of the left-hand side variables, as in (12) in the paper. For given values of the degrees of freedom and mismeasurement parameters, the point estimates for the industry and year fixed effects and coefficients on lagged values that maximize the likelihood are given by $\widehat{\boldsymbol{\beta}} = (\mathbf{X}'\mathbf{W}\mathbf{X})^{-1}(\mathbf{X}'\mathbf{W}\mathbf{Y})$, where $w_i = [\hat{\nu} + \hat{\boldsymbol{\varepsilon}}_i'\widehat{\boldsymbol{\Sigma}}^{-1}\hat{\boldsymbol{\varepsilon}}_i]^{-1}$, $\widehat{\boldsymbol{\Sigma}} = \hat{\boldsymbol{\varepsilon}}'\mathbf{W}\hat{\boldsymbol{\varepsilon}}/\text{sum}(\mathbf{W})$ & $\hat{\boldsymbol{\varepsilon}} = \mathbf{Y} - \mathbf{X}\widehat{\boldsymbol{\beta}}$. Starting with weights set equal to 1, I perform iterative least squares until the estimates converge and then calculate the ln-likelihood reported in the tables.

The value highlighted in bold in each table is the maximum value across the matrix of values presented in the table. The reader will see that there are no other local maxima. Starting anywhere else in each table there is always a higher ln-likelihood in the surrounding eight cells (three or six cells for border cells) such that by moving to that higher likelihood one eventually arrives at the maximum highlighted in bold.

Table A1: Concentrated Ln Likelihoods for Model 1 for Computer & Electronics Intermediates
as Function of Degrees of Freedom (Y axis) & Mismeasurement Parameter (X axis) – No Lags

	-1.5	-1.4	-1.3	-1.2	-1.1	-1.0	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
.1	6265.5	6251.8	6252.7	6284	6278.7	6296.1	6351	6330.3	6356	6327.6	6326.1	6372.2	6339	6363.6	6295.4	6297.8	6290.3	6285.4	6328.9	6300.7	6346.5	6289.2	6300.9	6255.7	6264.4	6241.4	6200.3	6233.7	6230	6171.8	6189.1
.2	6552.7	6559.6	6566.5	6574.5	6582.8	6590.3	6597.7	6605.8	6619.1	6626.8	6635.1	6632.7	6624.8	6616.3	6606.9	6594.1	6578.5	6568.3	6565.6	6556.2	6552	6544.3	6537.1	6526.6	6520.7	6513.6	6505.6	6498.2	6490.5	6482.5	6473.3
.3	6835.7	6843.0	6850.2	6857.5	6865.2	6873.4	6882.6	6892.4	6900.7	6908.7	6910.2	6908.4	6901.8	6893.9	6886.8	6875.7	6864.4	6854.8	6850.8	6848.4	6841.4	6825.3	6817.7	6809.6	6802.2	6796.8	6789.8	6782.5	6771.9	6764.6	6757.2
.4	7004.1	7011.5	7018.8	7026.3	7034.0	7041.3	7050.6	7060.4	7068.8	7076.8	7081.6	7079.5	7073.2	7064.0	7056.5	7046.6	7034.8	7025.7	7021.8	7014.6	7007.5	7000.6	6993.7	6989.8	6971.6	6964.1	6956.6	6949.4	6942.2	6935.0	6927.9
.5	7111.6	7118.9	7126.3	7133.8	7141.5	7149.6	7158.8	7168.4	7176.8	7184.5	7188.6	7186.7	7180.6	7172.1	7164.8	7154.6	7143.0	7140.3	7132.7	7125.4	7117.6	7110.6	7103.7	7096.8	7089.9	7083.0	7076.1	7069.2	7050.0	7043.0	7036.0
.6	7186.7	7194.0	7201.4	7209.0	7216.8	7225.2	7234.5	7244.0	7249.7	7257.2	7263.5	7261.7	7255.7	7247.3	7239.7	7229.6	7220.4	7212.2	7204.6	7197.4	7190.3	7183.4	7176.5	7169.7	7163	7156.2	7149.4	7142.7	7135.9	7129.2	7121.9
.7	7236.7	7244.0	7251.4	7259.0	7266.9	7275.3	7284.8	7294.1	7302.4	7309.8	7313.3	7311.6	7305.8	7297.4	7289.8	7279.7	7270.3	7262.1	7254.5	7247.2	7240.2	7233.3	7226.5	7219.8	7213.1	7206.4	7199.8	7193.1	7186.5	7179.8	7173.1
.8	7271.5	7278.8	7286.3	7293.9	7301.8	7310.3	7319.9	7329.2	7337.5	7344.8	7348.2	7346.6	7340.9	7332.7	7324.9	7314.9	7305.4	7297.0	7289.3	7282.1	7275.0	7268.2	7261.4	7254.7	7248.1	7241.5	7234.9	7228.3	7221.8	7215.2	7208.6
.9	7295.8	7303.0	7310.4	7318.1	7326.1	7334.7	7344.3	7353.6	7362.1	7369.1	7372.5	7371.0	7365.5	7357.4	7349.4	7339.6	7329.9	7321.5	7313.7	7306.4	7299.3	7292.5	7285.8	7279.1	7272.5	7266.0	7259.5	7252.9	7246.4	7240.0	7233.5
1.0	7312.3	7319.6	7327.0	7334.7	7342.7	7351.4	7361.1	7370.5	7378.9	7385.8	7389.1	7387.7	7382.4	7374.5	7366.4	7356.8	7346.9	7338.3	7330.5	7323.1	7316.1	7309.2	7302.5	7295.9	7289.3	7282.8	7276.3	7269.9	7263.4	7257.0	7250.6
1.1	7336.6	7343.9	7351.4	7359.1	7367.3	7376.1	7385.9	7395.3	7403.7	7410.6	7413.8	7412.5	7407.3	7399.5	7391.3	7381.9	7371.8	7363.0	7355.1	7347.6	7340.5	7333.6	7326.9	7320.2	7313.7	7307.1	7300.7	7294.2	7287.8	7281.4	7275.0
1.2	7343.4	7350.7	7358.2	7365.9	7374.2	7383.1	7393.0	7402.3	7410.8	7417.5	7420.7	7419.4	7414.4	7406.8	7398.6	7389.3	7379.2	7370.2	7362.1	7354.6	7347.4	7340.5	7333.8	7327.1	7320.6	7314.1	7307.7	7301.3	7294.9	7288.5	7282.2
1.3	7346.9	7354.2	7361.7	7369.5	7377.9	7386.9	7396.8	7406.1	7414.6	7421.2	7424.3	7423.1	7418.2	7410.8	7402.6	7393.4	7383.3	7374.1	7365.9	7358.3	7351.1	7344.2	7337.4	7330.8	7324.2	7317.8	7311.3	7305.0	7298.6	7292.3	7286.0
1.4	7347.8	7355.2	7362.7	7370.6	7379.0	7388.2	7398.1	7407.4	7415.9	7422.4	**7425.5**	7424.3	7419.5	7412.3	7404.1	7395.0	7385.0	7375.6	7367.2	7359.5	7352.3	7345.3	7338.5	7331.8	7325.3	7318.8	7312.4	7306.0	7299.7	7293.4	7287.1
1.5	7346.8	7354.2	7361.8	7369.8	7378.2	7387.5	7397.4	7406.8	7415.1	7421.6	7424.6	7423.5	7418.8	7411.7	7403.6	7394.6	7384.6	7375.0	7366.6	7358.8	7351.4	7344.4	7337.5	7330.9	7324.3	7317.8	7311.4	7305.1	7298.8	7292.5	7286.2
1.6	7344.3	7351.7	7359.3	7367.4	7375.9	7385.2	7395.2	7404.6	7412.9	7419.2	7422.2	7421.1	7416.5	7409.6	7401.5	7392.6	7382.7	7373.0	7364.3	7356.4	7349.0	7341.9	7335.0	7328.3	7321.7	7315.3	7308.9	7302.5	7296.2	7289.9	7283.7
1.7	7340.5	7347.9	7355.6	7363.7	7372.4	7381.8	7391.8	7401.1	7409.4	7415.6	7418.5	7417.4	7412.9	7406.1	7398.2	7389.3	7379.4	7369.7	7360.8	7352.8	7345.3	7338.1	7331.2	7324.5	7317.9	7311.4	7305.0	7298.6	7292.3	7286.1	7279.8
1.8	7335.7	7343.2	7350.9	7359.1	7367.8	7377.3	7387.3	7396.7	7404.9	7411.0	7413.8	7412.8	7408.4	7401.7	7393.8	7385.0	7375.2	7365.4	7356.4	7348.2	7340.6	7333.4	7326.4	7319.6	7313.0	7306.5	7300.1	7293.7	7287.4	7281.2	7275.0
1.9	7330.1	7337.7	7345.5	7353.7	7362.5	7372.1	7382.1	7391.4	7399.6	7405.6	7408.4	7407.3	7403.0	7396.5	7388.7	7379.9	7370.1	7360.3	7351.2	7342.9	7335.2	7327.8	7320.8	7314.0	7307.3	7300.8	7294.4	7288	7281.7	7275.4	7269.2
2.0	7323.9	7331.5	7339.4	7347.7	7356.6	7366.3	7376.3	7385.6	7393.6	7399.6	7402.3	7401.2	7397.0	7390.6	7382.8	7374.1	7364.4	7354.5	7345.3	7336.9	7329.1	7321.7	7314.6	7307.7	7301.0	7294.5	7288.0	7281.6	7275.3	7269.0	7262.8
2.1	7317.2	7324.8	7332.8	7341.2	7350.2	7359.9	7369.9	7379.2	7387.2	7393.0	7395.7	7394.6	7390.5	7384.2	7376.5	7367.8	7358.2	7348.3	7338.9	7330.4	7322.5	7315.0	7307.8	7300.9	7294.2	7287.6	7281.1	7274.7	7268.4	7262.1	7255.9
2.2	7310.1	7317.8	7325.8	7334.3	7343.4	7353.2	7363.2	7372.4	7380.3	7386.1	7388.7	7387.6	7383.6	7377.3	7369.7	7361.1	7351.5	7341.6	7332.2	7323.5	7315.5	7307.9	7300.7	7293.7	7286.9	7280.3	7273.8	7267.3	7261.0	7254.7	7248.5
2.3	7302.6	7310.4	7318.5	7327.1	7336.3	7346.1	7356.1	7365.3	7373.1	7378.8	7381.3	7380.3	7376.3	7370.2	7362.6	7354	7344.5	7334.6	7325.1	7316.3	7308.2	7300.5	7293.2	7286.2	7279.3	7272.7	7266.1	7259.7	7253.3	7247.0	7240.8
2.4	7295.0	7302.8	7310.9	7319.6	7328.9	7338.8	7348.8	7357.9	7365.7	7371.3	7373.7	7372.7	7368.8	7362.7	7355.2	7346.7	7337.2	7327.3	7317.8	7308.9	7300.6	7292.9	7285.5	7278.4	7271.5	7264.8	7258.2	7251.7	7245.3	7239.0	7232.8
2.5	7287.1	7294.9	7303.2	7311.9	7321.3	7331.3	7341.2	7350.3	7358.1	7363.5	7365.9	7365.0	7361.1	7355.1	7347.6	7339.1	7329.7	7319.8	7310.2	7301.2	7292.9	7285.0	7277.6	7270.4	7263.5	7256.7	7250.1	7243.6	7237.2	7230.8	7224.5
2.6	7279.0	7287.0	7295.3	7304.1	7313.6	7323.6	7333.5	7342.6	7350.2	7355.6	7358.0	7357.0	7353.2	7347.3	7339.9	7331.4	7322.1	7312.2	7302.5	7293.5	7285.0	7277.1	7269.5	7262.3	7255.3	7248.5	7241.8	7235.3	7228.8	7222.5	7216.2
2.7	7270.9	7278.9	7287.3	7296.2	7305.8	7315.8	7325.7	7334.8	7342.3	7347.7	7350.0	7349.0	7345.2	7339.3	7332.0	7323.6	7314.3	7304.4	7294.7	7285.6	7277.0	7269.0	7261.4	7254.1	7247	7240.2	7233.5	7226.9	7220.4	7214.0	7207.7
2.8	7262.7	7270.8	7279.3	7288.3	7297.9	7307.9	7317.8	7326.8	7334.3	7339.6	7341.9	7340.9	7337.2	7331.3	7324.1	7315.7	7306.4	7296.6	7286.9	7277.6	7269.0	7260.9	7253.2	7245.8	7238.7	7231.8	7225.0	7218.4	7211.9	7205.5	7199.2
2.9	7254.5	7262.6	7271.2	7280.3	7290.0	7300.0	7309.9	7318.8	7326.3	7331.5	7333.7	7332.7	7329.0	7323.3	7316.1	7307.8	7298.5	7288.7	7278.9	7269.6	7260.9	7252.7	7244.9	7237.5	7230.3	7223.3	7216.5	7209.9	7203.4	7196.9	7190.6
3.0	7246.3	7254.5	7263.1	7272.3	7282.0	7292.1	7301.9	7310.8	7318.2	7323.3	7325.5	7324.6	7320.9	7315.2	7308.0	7299.8	7290.6	7280.8	7271.0	7261.6	7252.8	7244.5	7236.7	7229.1	7221.9	7214.9	7208.1	7201.4	7194.8	7188.3	7181.9

Table A2: Concentrated Ln Likelihoods for Model 1 for Computer & Electronics Intermediates
as Function of Degrees of Freedom (Y axis) & Mismeasurement Parameter (X axis) – 1 Lag

	-1.5	-1.4	-1.3	-1.2	-1.1	-1.0	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
.1	6186.8	6169.8	6130.8	6204.7	6253.7	6268.6	6222.6	6210.1	6197.6	6288.1	6250.8	6232.6	6204.9	6249.2	6204.6	6243.6	6195.7	6226.9	6246.4	6204.6	6189.5	6169.8	6207.8	6168.7	6148.0	6189.9	6128.4	6168.2	6173.8	6152.6	6112.4
.2	6369.7	6374.3	6377.6	6382.3	6390.6	6393.0	6398.2	6407.3	6413.1	6419.4	6424.6	6431.3	6435.4	6427.2	6416.0	6412.2	6405.7	6399.0	6389.3	6380.7	6368.9	6353.9	6345.8	6339.3	6331.0	6322.0	6315.6	6305.4	6297.5	6290.4	6285.6
.3	6629.4	6635.3	6640.9	6646.2	6653.5	6659.6	6666.0	6674.1	6681.7	6689.9	6700.1	6705.9	6706.8	6700.4	6691.8	6682.6	6677.5	6666.6	6654.4	6647.0	6639.5	6631.6	6616.4	6608.3	6600.2	6592.0	6584.8	6576.1	6569.1	6562.1	6553.9
.4	6783.0	6789.6	6797.0	6803.5	6810.0	6816.5	6823.4	6830.6	6838.2	6846.7	6857.1	6863.1	6863.2	6856.6	6847.9	6840.2	6833.1	6822.8	6813.9	6803.8	6796.5	6789.2	6782.0	6774.9	6767.7	6749.3	6741.8	6734.4	6727.1	6720.0	6712.9
.5	6884.6	6891.5	6898.3	6905.0	6910.8	6917.5	6924.4	6931.7	6939.4	6948.0	6958.5	6964.9	6965.1	6958.6	6949.9	6942.4	6934.9	6924.4	6915.9	6906.5	6898.7	6890.2	6883.0	6875.9	6868.7	6861.6	6854.5	6847.3	6828.3	6821.1	6813.9
.6	6950.7	6957.5	6964.4	6971.2	6978.0	6984.8	6991.8	6999.0	7006.9	7015.6	7026.2	7032.7	7032.8	7026.4	7017.7	7010.2	7002.5	6992.1	6983.4	6975.3	6967.5	6959.9	6952.0	6944.8	6937.6	6930.5	6923.3	6916.2	6909.1	6902.0	6895.0
.7	6995.5	7002.4	7009.2	7016.1	7022.9	7029.8	7036.9	7044.3	7052.2	7061.2	7071.8	7078.3	7078.4	7072.1	7063.6	7055.9	7048.3	7038.0	7029.1	7021.0	7013.2	7005.7	6998.3	6990.9	6983.8	6976.7	6969.7	6962.6	6955.6	6948.7	6941.7
.8	7026.1	7033.0	7039.8	7046.6	7053.5	7060.5	7067.7	7075.2	7083.3	7092.5	7103.1	7109.5	7109.6	7103.6	7095.1	7087.4	7079.7	7069.5	7060.4	7052.3	7044.5	7037.0	7029.7	7022.4	7015.4	7008.4	7001.5	6994.5	6987.6	6980.7	6973.8
.9	7046.8	7053.6	7060.4	7067.2	7074.2	7081.2	7088.4	7096.1	7104.4	7113.9	7124.4	7130.6	7130.8	7124.9	7116.5	7108.7	7101.1	7090.9	7081.7	7073.5	7065.7	7058.3	7051.0	7043.8	7036.9	7029.9	7023.0	7016.2	7009.3	7002.5	6995.7
1.0	7060.2	7067.0	7073.8	7080.7	7087.6	7094.7	7102.1	7109.8	7118.3	7128.0	7138.3	7144.5	7144.6	7139.0	7130.7	7122.8	7115.1	7105.1	7095.7	7087.4	7079.7	7072.2	7065.0	7057.9	7050.9	7044.0	7037.2	7030.4	7023.6	7016.8	7010.1
1.1	7068.4	7075.1	7081.9	7088.8	7095.8	7103.0	7110.4	7118.3	7126.9	7136.9	7147.0	7153.0	7153.1	7147.6	7139.5	7131.5	7123.8	7113.9	7104.4	7096.0	7088.2	7080.8	7073.6	7066.5	7059.6	7052.7	7045.9	7039.1	7032.4	7025.7	7019.0
1.2	7072.6	7079.3	7086.1	7093.0	7100.0	7107.3	7114.8	7122.8	7131.6	7141.7	7151.6	7157.4	7157.6	7152.2	7144.2	7136.2	7128.4	7118.7	7109.0	7100.6	7092.7	7085.3	7078.1	7071.0	7064.1	7057.3	7050.5	7043.8	7037.1	7030.5	7023.8
1.3	7073.8	7080.5	7087.3	7094.2	7101.3	7108.6	7116.2	7124.4	7133.4	7143.5	7153.2	7158.8	**7158.9**	7153.7	7145.8	7137.8	7130.0	7120.3	7110.7	7102.1	7094.2	7086.7	7079.5	7072.5	7065.6	7058.7	7052.0	7045.3	7038.7	7032.0	7025.5
1.4	7072.7	7079.4	7086.2	7093.2	7100.3	7107.6	7115.3	7123.6	7132.8	7143.0	7152.4	7157.8	7157.9	7152.8	7145.1	7137.1	7129.2	7119.6	7109.9	7101.3	7093.3	7085.8	7078.5	7071.5	7064.6	7057.8	7051.1	7044.4	7037.8	7031.2	7024.6
1.5	7069.8	7076.5	7083.4	7090.3	7097.5	7104.9	7112.7	7121.1	7130.4	7140.6	7149.8	7155.0	7155.1	7150.1	7142.5	7134.5	7126.6	7117.1	7107.4	7098.6	7090.6	7083.0	7075.7	7068.7	7061.8	7055.0	7048.2	7041.6	7035.0	7028.5	7021.9
1.6	7065.6	7072.3	7079.1	7086.1	7093.3	7100.8	7108.7	7117.3	7126.7	7136.9	7145.7	7150.8	7150.8	7146.0	7138.5	7130.5	7122.5	7113.1	7103.4	7094.5	7086.4	7078.8	7071.5	7064.4	7057.5	7050.7	7044.0	7037.3	7030.8	7024.2	7017.8
1.7	7071.8	7078.6	7085.5	7092.5	7099.8	7107.5	7115.6	7112.4	7121.9	7132.0	7140.6	7145.5	7145.4	7140.7	7133.3	7125.4	7117.4	7108.0	7098.2	7089.3	7081.1	7073.4	7066.1	7059.0	7052.0	7045.2	7038.5	7031.9	7025.4	7018.9	7012.4
1.8	7065.9	7072.7	7079.6	7086.7	7094.1	7101.8	7110.1	7119.0	7128.8	7126.3	7134.6	7139.2	7139.1	7134.5	7127.3	7119.4	7111.3	7102.0	7092.2	7083.2	7075.0	7067.2	7059.8	7052.7	7045.7	7038.9	7032.2	7025.6	7019.1	7012.6	7006.1
1.9	7059.4	7066.2	7073.1	7080.3	7087.7	7095.5	7103.9	7112.9	7122.7	7132.1	7127.9	7132.3	7132.1	7127.6	7120.6	7112.7	7104.6	7095.3	7085.6	7076.5	7068.1	7060.3	7052.9	7045.7	7038.7	7031.9	7025.2	7018.6	7012.0	7005.6	6999.2
2.0	7052.3	7059.1	7066.1	7073.3	7080.8	7088.7	7097.1	7106.2	7116.0	7125.3	7132.3	7124.9	7124.6	7120.2	7113.3	7105.4	7097.3	7088.1	7078.3	7069.2	7060.8	7052.9	7045.4	7038.2	7031.2	7024.3	7017.6	7011.0	7004.5	6998.0	6991.6
2.1	7044.8	7051.6	7058.6	7065.9	7073.4	7081.4	7089.9	7099.2	7108.9	7118.0	7124.8	7128.3	7116.7	7112.4	7105.5	7097.8	7089.6	7080.4	7070.7	7061.5	7053.0	7045.0	7037.5	7030.2	7023.2	7016.3	7009.6	7003.0	6996.5	7000.8	6994.4
2.2	7037.0	7043.8	7050.9	7058.2	7065.8	7073.8	7082.5	7091.7	7101.4	7110.4	7117.0	7120.3	7119.4	7104.2	7097.5	7089.8	7081.6	7072.4	7062.7	7053.5	7044.9	7036.9	7029.3	7022.0	7025.6	7018.8	7012.1	7005.5	6999.1	6992.7	6986.3
2.3	7028.9	7035.8	7042.9	7050.2	7057.9	7066.1	7074.8	7084.1	7093.7	7102.5	7108.9	7112.0	7111.2	7106.7	7100.0	7092.3	7084.0	7074.7	7065.0	7055.8	7047.2	7039.2	7031.6	7024.3	7017.3	7010.5	7003.8	6997.2	6990.7	6984.3	6977.9
2.4	7020.7	7027.6	7034.7	7042.1	7049.9	7058.1	7066.9	7076.3	7085.8	7094.4	7100.7	7103.6	7102.7	7098.3	7091.7	7084.0	7075.7	7066.5	7056.8	7047.5	7038.9	7030.8	7023.2	7015.9	7008.8	7001.9	6995.2	6988.6	6982.1	6975.7	6969.4
2.5	7012.3	7019.3	7026.4	7033.9	7041.7	7050.0	7058.9	7068.3	7077.8	7086.2	7092.2	7095.0	7094.1	7089.8	7083.2	7075.6	7067.3	7058.1	7048.4	7039.1	7030.5	7022.3	7014.6	7007.3	7000.2	6993.2	6986.5	6979.9	6973.4	6967.0	6960.6
2.6	7003.9	7010.9	7018.1	7025.6	7033.5	7041.9	7050.8	7060.2	7069.6	7077.8	7083.7	7086.4	7085.4	7081.1	7074.7	7067.2	7058.8	7049.6	7040.0	7030.7	7021.9	7013.7	7006.0	6998.6	6991.4	6984.5	6977.7	6971.1	6964.6	6958.2	6951.8
2.7	6995.4	7002.4	7009.7	7017.3	7025.2	7033.7	7042.7	7052.1	7061.4	7069.4	7075.1	7077.7	7076.7	7072.4	7066.1	7058.6	7050.3	7041.1	7031.5	7022.1	7013.4	7005.1	6997.3	6989.8	6982.7	6975.7	6968.9	6962.3	6955.7	6949.3	6943.0
2.8	6986.9	6993.9	7001.3	7008.9	7016.9	7025.5	7034.5	7043.9	7053.1	7061.0	7066.5	7069.0	7067.9	7063.7	7057.5	7050.0	7041.8	7032.6	7023.0	7013.6	7004.8	6996.5	6988.6	6981.1	6973.9	6966.9	6960.1	6953.4	6946.8	6940.4	6934.1
2.9	6978.4	6985.5	6992.9	7000.6	7008.7	7017.3	7026.3	7035.7	7044.8	7052.5	7057.9	7060.2	7059.1	7055.0	7048.9	7041.5	7033.2	7024.1	7014.5	7005.1	6996.2	6987.8	6979.9	6972.4	6965.1	6958.0	6951.2	6944.5	6938.0	6931.5	6925.2
3.0	6969.9	6977.0	6984.5	6992.3	7000.4	7009.1	7018.2	7027.6	7036.5	7044.1	7049.3	7051.5	7050.4	7046.4	7040.2	7032.9	7024.7	7015.6	7006.0	6996.5	6987.6	6979.2	6971.3	6963.6	6956.3	6949.3	6942.4	6935.7	6929.1	6922.6	6916.3

Table A3: Concentrated Ln Likelihoods for Model 1 for Computer & Electronics Intermediates
as Function of Degrees of Freedom (Y axis) & Mismeasurement Parameter (X axis) – 2 Lags

	-1.5	-1.4	-1.3	-1.2	-1.1	-1.0	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
.1	6012.5	6048.8	6048.3	6068.6	6091.6	6047.6	6015.9	6027.5	6093.3	6174.2	6088.9	6088.2	6063.7	6108.3	6090.0	6129.9	6076.7	6112.7	6106.5	6070.0	6077.1	6035.1	6040.2	6045.8	6014.0	5966.6	6117.0	5993.6	5978.8	5947.8	6008.5
.2	6123.5	6130.9	6137.4	6143.6	6149.6	6159.6	6167.8	6176.5	6183.4	6190.8	6197.6	6198.3	6197.5	6195.0	6186.7	6179.2	6179.3	6173.8	6160.3	6153.2	6146.1	6134.5	6125.0	6115.8	6109.8	6102.9	6096.1	6085.8	6071.9	6064.8	6060.9
.3	6381.5	6386.6	6393.4	6400.3	6406.9	6412.0	6418.7	6426.4	6434.1	6444.3	6451.4	6452.6	6451.9	6443.2	6437.7	6428.1	6420.5	6413.1	6406.1	6398.2	6398.9	6381.8	6377.4	6370.8	6364.2	6357.7	6351.4	6344.7	6338.0	6331.4	6313.6
.4	6527.6	6534.1	6540.5	6546.9	6553.4	6560.0	6566.8	6574.0	6579.7	6589.7	6596.2	6595.7	6593.9	6585.3	6580.3	6572.7	6562.9	6555.1	6547.3	6546.0	6540.0	6534.1	6527.0	6520.8	6503.8	6497.1	6490.4	6484.2	6478.0	6471.4	6464.8
.5	6621.5	6627.8	6634.1	6640.4	6646.8	6653.3	6660.0	6667.1	6675.1	6683.7	6693.6	6694.8	6687.3	6679.5	6672.8	6665.4	6656.3	6647.3	6643.3	6637.1	6631.0	6625.0	6618.9	6612.8	6611.0	6604.6	6598.1	6591.6	6585.1	6578.6	6559.9
.6	6684.4	6690.6	6696.9	6703.1	6709.4	6715.9	6722.6	6729.6	6737.4	6746.2	6755.3	6757.7	6755.3	6748.9	6740.9	6735.2	6725.4	6717.6	6709.9	6704.1	6697.7	6691.4	6685.1	6678.8	6672.5	6666.2	6659.8	6653.3	6646.9	6640.4	6633.9
.7	6727.3	6733.5	6739.7	6745.9	6752.2	6758.6	6765.3	6772.4	6780.4	6788.9	6798.2	6800.3	6797.9	6791.5	6784.3	6777.8	6768.0	6760.0	6752.9	6746.3	6739.9	6733.5	6727.2	6720.9	6714.5	6708.2	6701.8	6695.4	6689.0	6682.6	6676.1
.8	6756.7	6762.9	6769.0	6775.3	6781.6	6788.1	6794.8	6801.9	6809.8	6818.5	6827.5	6829.5	6827.0	6820.7	6813.5	6806.8	6797.2	6788.9	6781.7	6775.0	6768.5	6762.1	6755.8	6749.5	6743.2	6736.9	6730.5	6724.2	6717.8	6711.4	6705.0
.9	6776.5	6782.7	6788.9	6795.2	6801.5	6808.0	6814.7	6821.9	6829.9	6838.5	6847.3	6849.2	6846.6	6840.3	6833.2	6826.4	6816.9	6808.4	6801.1	6794.3	6787.7	6781.3	6775.0	6768.7	6762.4	6756.1	6749.8	6743.5	6737.2	6730.8	6724.5
1.0	6789.5	6795.7	6801.9	6808.1	6814.5	6821.0	6827.8	6835.1	6843.2	6851.6	6860.1	6862.0	6859.3	6853.2	6846.0	6839.2	6829.8	6821.1	6813.6	6806.7	6800.1	6793.6	6787.3	6781.0	6774.8	6768.5	6762.2	6756.0	6749.7	6743.4	6737.1
1.1	6798.9	6805.1	6811.3	6817.6	6824.0	6830.6	6837.4	6843.3	6851.4	6860.9	6867.9	6869.7	6867.0	6860.9	6853.8	6846.9	6837.6	6828.7	6821.1	6814.1	6807.4	6800.9	6794.6	6788.3	6782.1	6775.8	6767.3	6761.2	6755.0	6748.8	6742.6
1.2	6802.8	6809.0	6815.2	6821.5	6827.9	6834.5	6841.4	6848.8	6855.8	6865.1	6871.8	**6873.5**	6870.8	6864.9	6857.8	6850.7	6841.6	6832.6	6824.8	6817.7	6811.0	6804.5	6795.9	6789.6	6783.5	6777.3	6771.2	6765.1	6758.9	6752.8	6746.7
1.3	6803.8	6810.0	6816.2	6822.5	6829.0	6835.6	6842.6	6850.0	6858.0	6866.4	6872.8	6873.3	6870.1	6865.9	6858.8	6851.7	6842.6	6833.5	6825.7	6816.4	6809.6	6803.1	6796.8	6790.6	6784.4	6778.3	6772.2	6766.1	6760.0	6754.0	6747.9
1.4	6802.6	6808.7	6815.0	6821.3	6827.8	6834.5	6841.5	6849.0	6857.1	6865.4	6871.9	6872.3	6869.0	6862.9	6855.9	6848.5	6841.5	6832.3	6822.4	6815.2	6808.4	6801.9	6795.5	6789.3	6783.1	6777.1	6771.0	6765.0	6758.9	6752.9	6746.9
1.5	6799.6	6805.8	6812.0	6818.4	6824.9	6831.7	6838.8	6846.4	6854.6	6864.4	6869.3	6869.7	6866.3	6860.3	6853.3	6845.8	6836.8	6827.7	6819.6	6812.4	6805.5	6799.0	6792.6	6786.4	6780.2	6774.2	6768.1	6762.1	6756.1	6750.1	6744.1
1.6	6797.8	6803.9	6810.1	6814.1	6820.7	6827.5	6834.7	6842.4	6850.7	6860.6	6865.4	6865.7	6862.3	6856.3	6849.4	6841.8	6832.8	6823.7	6815.6	6808.2	6801.4	6794.8	6788.4	6782.1	6776.0	6769.9	6763.9	6757.9	6751.9	6746.0	6740.0
1.7	6792.7	6798.8	6805.1	6811.5	6818.1	6825.0	6832.3	6840.1	6848.2	6855.8	6860.4	6860.6	6857.3	6851.4	6844.4	6836.8	6827.8	6818.7	6810.6	6803.1	6796.2	6789.6	6783.2	6776.9	6770.7	6764.6	6758.6	6752.6	6746.7	6740.7	6734.8
1.8	6786.8	6793.0	6799.2	6805.7	6812.3	6819.3	6826.7	6834.5	6842.7	6850.1	6854.5	6854.8	6851.5	6845.6	6838.7	6831.1	6822.1	6813.0	6804.8	6797.3	6790.3	6783.6	6777.1	6770.8	6764.6	6758.5	6752.5	6746.5	6740.6	6734.7	6728.8
1.9	6780.3	6786.4	6792.7	6799.2	6805.9	6813.0	6820.4	6828.3	6836.4	6843.7	6848.0	6848.3	6845.0	6839.3	6832.4	6824.7	6815.8	6806.7	6798.4	6790.8	6783.7	6776.9	6770.4	6764.1	6757.9	6751.8	6745.8	6739.8	6733.9	6728.0	6722.1
2.0	6773.2	6779.4	6785.8	6792.3	6799.0	6806.1	6813.6	6821.6	6829.7	6836.8	6841.0	6841.2	6838.0	6832.4	6825.6	6817.9	6809.1	6799.9	6791.5	6783.8	6776.6	6769.8	6763.3	6756.9	6750.7	6744.6	6738.6	6732.6	6726.7	6720.8	6714.9
2.1	6765.8	6772.0	6778.4	6785.0	6791.8	6798.9	6806.5	6814.5	6822.5	6829.5	6833.6	6833.8	6830.6	6825.1	6818.3	6810.7	6801.9	6792.7	6784.2	6776.5	6769.2	6762.4	6755.8	6749.4	6743.1	6737.0	6730.9	6725.0	6719.0	6713.1	6707.3
2.2	6758.1	6764.4	6770.7	6777.3	6784.2	6791.4	6799.1	6807.1	6815.1	6821.9	6825.8	6826.0	6822.9	6817.5	6810.8	6803.2	6794.4	6785.3	6776.7	6768.8	6761.5	6754.6	6747.9	6741.5	6735.2	6729.1	6723.0	6717.0	6711.1	6705.2	6699.4
2.3	6750.2	6756.5	6762.9	6769.5	6776.4	6783.7	6791.4	6799.4	6807.3	6814.0	6817.9	6818.1	6815.0	6809.6	6803.0	6795.4	6786.7	6777.6	6768.9	6761.0	6753.6	6746.6	6739.9	6733.4	6727.1	6721.0	6714.9	6708.9	6703.0	6697.1	6691.2
2.4	6742.1	6748.4	6754.8	6761.5	6768.5	6775.8	6783.6	6791.6	6799.4	6806.0	6809.7	6809.9	6806.9	6801.6	6795.0	6787.5	6778.8	6769.7	6761.0	6753.0	6745.5	6738.4	6731.7	6725.2	6718.9	6712.7	6706.6	6700.6	6694.6	6688.8	6682.9
2.5	6733.9	6740.2	6746.7	6753.4	6760.4	6767.8	6775.6	6783.6	6791.4	6797.8	6801.4	6801.6	6798.7	6793.5	6786.9	6779.4	6770.8	6761.7	6753.0	6744.9	6737.3	6730.2	6723.4	6716.8	6710.5	6704.3	6698.1	6692.1	6686.2	6680.3	6674.5
2.6	6725.6	6731.9	6738.5	6745.2	6752.3	6759.7	6767.6	6775.6	6783.3	6789.5	6793.1	6793.2	6790.4	6785.3	6778.8	6771.3	6762.7	6753.6	6744.9	6736.7	6729.1	6721.9	6715.0	6708.4	6702.0	6695.8	6689.6	6683.6	6677.7	6671.8	6665.9
2.7	6717.3	6723.6	6730.2	6737.0	6744.1	6751.6	6759.5	6767.5	6775.1	6781.2	6784.7	6784.8	6782.0	6777.0	6770.5	6763.1	6754.6	6745.5	6736.7	6728.5	6720.8	6713.5	6706.6	6700.0	6693.5	6687.2	6681.1	6675.0	6669.1	6663.2	6657.4
2.8	6708.9	6715.3	6721.9	6728.8	6736.0	6743.5	6751.4	6759.4	6766.9	6772.9	6776.3	6776.4	6773.6	6768.7	6762.3	6754.8	6746.4	6737.4	6728.5	6720.2	6712.5	6705.2	6698.2	6691.5	6685.0	6678.7	6672.5	6666.5	6660.5	6654.6	6648.7
2.9	6700.6	6707.0	6713.7	6720.6	6727.8	6735.4	6743.3	6751.2	6758.7	6764.6	6767.9	6768.0	6765.2	6760.3	6754.0	6746.6	6738.2	6729.2	6720.3	6712.0	6704.2	6696.8	6689.8	6683.0	6676.5	6670.2	6664.0	6657.9	6651.9	6646.0	6640.1
3.0	6692.3	6698.7	6705.4	6712.4	6719.7	6727.3	6735.2	6743.1	6750.5	6756.3	6759.5	6759.6	6756.9	6752.0	6745.8	6738.4	6730.0	6721.1	6712.2	6703.8	6695.9	6688.5	6681.4	6674.6	6668.1	6661.7	6655.4	6649.3	6643.3	6637.4	6631.5

Table A4: Concentrated Ln Likelihoods for Model 1 for Computer & Electronics Intermediates
as Function of Degrees of Freedom (Y axis) & Mismeasurement Parameter (X axis) – 3 Lags

	-1.5	-1.4	-1.3	-1.2	-1.1	-1.0	-0.9	-0.8	-0.7	-0.6	-0.5	-0.4	-0.3	-0.2	-0.1	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5
.1	5901.4	5919.9	6041.8	5945.7	5937.6	5902.3	5858.3	5934.2	5903.2	5914.9	5894.5	5962.2	6018.3	6016.2	6026.1	5911.0	5993.3	6002.1	5962.7	5981.0	5906.9	5925.9	5903.3	5890.9	5901.1	5880.8	5863.8	5924.4	5842.7	5897.2	5843.9
.2	5894.9	5899.1	5904.1	5908.6	5910.6	5915.2	5921.0	5927.9	5931.1	5942.8	5947.6	5954.9	5954.4	5950.9	5949.5	5941.7	5919.8	5922.6	5911.5	5899.0	5899.0	5894.5	5888.0	5886.4	5884.6	5879.4	5861.9	5855.3	5847.4	5840.3	5826.7
.3	6124.1	6129.3	6134.3	6135.7	6140.5	6145.1	6151.6	6156.6	6161.2	6166.5	6170.2	6172.4	6173.6	6167.4	6168.6	6159.7	6162.0	6149.7	6147.6	6138.4	6126.4	6120.5	6124.2	6121.3	6115.0	6102.0	6095.3	6078.7	6071.8	6064.9	6058.0
.4	6255.7	6261.1	6266.4	6271.7	6277.0	6282.3	6287.7	6293.2	6298.8	6304.3	6306.1	6312.3	6316.2	6309.5	6305.1	6300.8	6297.2	6288.6	6281.8	6275.7	6269.8	6264.0	6258.1	6252.2	6246.3	6240.1	6233.8	6227.4	6221.1	6214.7	6208.4
.5	6336.1	6341.5	6346.9	6352.4	6357.9	6363.5	6369.2	6375.0	6380.7	6387.0	6394.9	6404.3	6407.0	6406.5	6401.8	6397.4	6392.5	6384.8	6378.1	6371.8	6365.8	6359.8	6347.7	6340.3	6334.4	6328.4	6322.6	6317.0	6311.1	6305.2	6299.4
.6	6398.8	6404.1	6409.5	6414.7	6420.2	6425.6	6431.4	6437.4	6443.6	6450.1	6457.7	6464.6	6466.9	6463.3	6460.1	6455.5	6450.6	6442.7	6435.9	6429.7	6423.6	6417.8	6411.9	6406.1	6400.3	6394.4	6388.5	6382.6	6376.6	6370.7	6364.7
.7	6440.1	6445.6	6451.0	6456.5	6462.1	6467.8	6473.5	6479.5	6485.8	6491.8	6498.2	6505.8	6507.6	6506.1	6500.5	6495.6	6490.5	6482.5	6475.6	6469.3	6463.4	6457.5	6451.8	6446.0	6440.3	6434.6	6428.9	6423.1	6417.4	6411.7	6405.9
.8	6469.1	6474.6	6480.0	6485.5	6491.1	6496.7	6502.5	6508.5	6514.5	6521.3	6527.6	6534.1	6535.7	6533.9	6528.4	6523.6	6518.3	6510.1	6503.1	6496.8	6490.8	6485.0	6479.3	6473.7	6468.1	6462.5	6457.0	6451.4	6445.8	6440.1	6434.5
.9	6488.8	6494.2	6499.7	6505.2	6510.7	6516.4	6521.9	6528.2	6534.7	6541.6	6547.7	6553.5	6554.9	6553.0	6547.6	6542.6	6536.7	6529.1	6522.0	6515.6	6508.0	6502.2	6496.6	6491.1	6485.6	6480.1	6474.7	6469.2	6463.7	6458.3	6452.8
1.0	6501.8	6507.2	6512.7	6518.2	6523.8	6529.4	6535.4	6541.7	6548.3	6555.2	6561.3	6566.3	6568.2	6565.5	6560.2	6555.1	6549.1	6540.9	6533.7	6527.2	6521.2	6515.4	6509.7	6504.2	6498.7	6492.8	6487.3	6481.9	6476.5	6471.1	6465.6
1.1	6510.0	6515.4	6521.3	6526.4	6532.1	6538.0	6544.0	6550.3	6557.0	6563.9	6569.8	6574.3	6575.9	6573.2	6568.0	6562.8	6556.8	6548.6	6541.3	6534.8	6528.8	6522.9	6517.3	6511.8	6506.3	6500.9	6495.4	6490.0	6484.6	6479.0	6473.6
1.2	6514.9	6520.3	6525.8	6531.2	6536.9	6542.8	6548.9	6555.3	6562.0	6568.8	6574.7	6578.9	6580.0	6577.3	6572.2	6567.0	6560.9	6552.8	6545.4	6538.8	6532.7	6526.9	6521.2	6515.7	6510.2	6504.8	6499.4	6494.1	6488.7	6483.3	6478.0
1.3	6516.6	6522.1	6527.6	6533.2	6538.9	6544.8	6551.0	6557.4	6564.2	6571.0	6576.7	6580.5	**6581.4**	6578.7	6573.6	6568.4	6562.2	6554.2	6546.8	6540.1	6534.0	6528.1	6522.4	6516.9	6511.4	6506.0	6500.7	6495.3	6490.0	6484.7	6479.3
1.4	6516.2	6521.7	6527.3	6532.9	6538.7	6544.6	6550.8	6557.3	6564.2	6570.9	6576.6	6579.9	6580.6	6578.0	6573.0	6567.7	6561.5	6553.5	6546.0	6539.3	6533.1	6527.2	6521.5	6516.0	6510.5	6505.1	6499.8	6494.5	6489.1	6483.9	6478.6
1.5	6514.2	6519.7	6525.2	6530.9	6536.8	6542.8	6549.0	6555.6	6562.5	6569.2	6574.7	6577.9	6578.3	6575.6	6570.7	6565.4	6559.1	6551.2	6543.7	6536.9	6530.7	6524.7	6519.0	6513.5	6508.0	6502.6	6497.3	6492.0	6486.7	6481.4	6476.2
1.6	6510.8	6516.3	6521.9	6527.7	6533.5	6539.6	6545.9	6552.5	6559.4	6566.1	6571.5	6574.6	6574.8	6572.0	6567.2	6561.8	6555.5	6547.7	6540.1	6533.3	6527.0	6521.0	6515.3	6509.7	6504.2	6498.8	6493.5	6488.2	6483.0	6477.8	6472.5
1.7	6506.4	6512.0	6517.6	6523.4	6529.3	6535.4	6541.8	6548.4	6555.3	6561.9	6567.2	6570.3	6570.3	6567.5	6562.7	6557.3	6550.9	6543.2	6535.5	6528.6	6522.3	6516.3	6510.5	6505.0	6499.5	6494.1	6488.8	6483.6	6478.4	6473.2	6468.0
1.8	6501.2	6506.8	6512.4	6518.2	6524.2	6530.3	6536.8	6543.5	6550.4	6556.9	6562.1	6565.1	6565.1	6562.3	6557.5	6552.1	6545.6	6537.8	6530.2	6523.3	6516.9	6510.9	6505.1	6499.6	6494.1	6488.8	6483.5	6478.2	6473.0	6467.8	6462.7
1.9	6495.3	6500.9	6506.6	6512.4	6518.4	6524.6	6531.1	6537.9	6544.8	6551.3	6556.4	6559.2	6559.3	6556.5	6551.8	6546.3	6539.7	6532.0	6524.3	6517.4	6511.0	6505.0	6499.2	6493.6	6488.1	6482.7	6477.4	6472.2	6467.0	6461.8	6456.7
2.0	6488.9	6494.5	6500.3	6506.1	6512.2	6518.4	6525.0	6531.8	6538.7	6545.1	6550.1	6552.9	6552.9	6550.1	6545.5	6540.0	6533.5	6525.8	6518.1	6511.1	6504.7	6498.6	6492.7	6487.1	6481.6	6476.2	6470.9	6465.6	6460.4	6455.3	6450.1
2.1	6482.1	6487.8	6493.5	6499.4	6505.5	6511.8	6518.4	6525.2	6532.1	6538.5	6543.4	6546.1	6546.1	6543.4	6538.8	6533.4	6526.8	6519.2	6511.5	6504.4	6497.9	6491.8	6485.9	6480.2	6474.7	6469.3	6463.9	6458.7	6453.5	6448.3	6443.2
2.2	6475.0	6480.7	6486.5	6492.4	6498.5	6504.9	6511.5	6518.4	6525.3	6531.5	6536.4	6539.0	6539.0	6536.3	6531.8	6526.4	6519.9	6512.2	6504.6	6497.4	6490.9	6484.6	6478.7	6473.0	6467.4	6462.0	6456.7	6451.4	6446.2	6441.0	6435.9
2.3	6467.6	6473.3	6479.2	6485.2	6491.3	6497.7	6504.4	6511.3	6518.2	6524.4	6529.1	6531.7	6531.6	6529.0	6524.6	6519.2	6512.6	6505.1	6497.4	6490.2	6483.5	6477.3	6471.3	6465.6	6460.0	6454.5	6449.2	6443.9	6438.6	6433.5	6428.3
2.4	6460.1	6465.8	6471.7	6477.7	6484.0	6490.4	6497.1	6504.0	6510.9	6517.0	6521.6	6524.1	6524.1	6521.5	6517.2	6511.8	6505.3	6497.7	6490.0	6482.8	6476.1	6469.7	6463.7	6457.9	6452.3	6446.8	6441.4	6436.1	6430.9	6425.7	6420.6
2.5	6452.5	6458.2	6464.1	6470.2	6476.4	6482.9	6489.7	6496.6	6503.4	6509.5	6514.0	6516.5	6516.4	6513.9	6509.6	6504.2	6497.7	6490.2	6482.5	6475.2	6468.5	6462.1	6456.0	6450.2	6444.5	6439.0	6433.6	6428.3	6423.0	6417.9	6412.7
2.6	6444.7	6450.5	6456.4	6462.5	6468.8	6475.4	6482.2	6489.1	6495.9	6501.9	6506.3	6508.7	6508.6	6506.2	6501.9	6496.5	6490.1	6482.6	6474.9	6467.6	6460.8	6454.3	6448.2	6442.3	6436.7	6431.1	6425.7	6420.3	6415.1	6409.9	6404.7
2.7	6436.9	6442.7	6448.7	6454.8	6461.2	6467.8	6474.6	6481.5	6488.3	6494.2	6498.6	6500.9	6500.8	6498.4	6494.2	6488.8	6482.4	6475.0	6467.3	6459.9	6453.0	6446.5	6440.4	6434.4	6428.7	6423.1	6417.7	6412.3	6407.1	6401.9	6396.7
2.8	6429.1	6434.9	6440.9	6447.1	6453.5	6460.1	6467.0	6473.9	6480.6	6486.5	6490.8	6493.1	6492.9	6490.5	6486.4	6481.1	6474.7	6467.3	6459.6	6452.2	6445.2	6438.7	6432.5	6426.5	6420.8	6415.2	6409.7	6404.3	6399.0	6393.8	6388.6
2.9	6421.2	6427.1	6433.2	6439.4	6445.8	6452.5	6459.3	6466.3	6473.0	6478.7	6483.0	6485.2	6485.1	6482.7	6478.6	6473.3	6466.9	6459.6	6451.9	6444.4	6437.5	6430.9	6424.6	6418.6	6412.8	6407.2	6401.7	6396.3	6391.0	6385.7	6380.5
3.0	6413.4	6419.3	6425.4	6431.7	6438.1	6444.8	6451.7	6458.7	6465.3	6471.0	6475.2	6477.3	6477.2	6474.9	6470.8	6465.5	6459.2	6451.9	6444.2	6436.7	6429.7	6423.0	6416.7	6410.7	6404.8	6399.2	6393.6	6388.2	6382.9	6377.7	6372.5

B. Westfall-Young Multiple Testing Adjustments

This appendix makes the Westfall-Young (1993) multiple testing adjustments mentioned in the paper, using the bootstrapped joint distribution of p-values to evaluate the probability of finding a p-value less than or equal to that of the minimum p-value in a group of tests. When used as a step-down procedure this requires "subset pivotality", i.e. that the distribution of test statistics for subsets of hypotheses does not depend upon the validity of others, which does not hold in this case, as the dependent variables are the same across all tests. However, the procedure is still valid as a single step testing procedure, evaluating all p-values against the distribution of the min p-value under the assumption that all nulls are true. As noted in the paper, with regards to the results in the sample, only those for computer & electronics intermediates are robustly significant individually, so step down procedures would not make a difference in the evaluation of other p-values.

The lefthand side of Table B1 begins by reporting the p-value range for the individual test, based upon the extreme (0,1) values the uniformly distributed variable u can take in the formula (G+u)/(M+1), where M is the number of bootstrap draws. In the paper I use 99 successfully convergent bootstrap draws to evaluate the p-value for each individual model but here, as the Westfall-Young adjustment depends upon the joint distribution, I report results based upon the M iterations that successfully converged for all four computer related tests. Consequently, the denominator M+1 is usually a few less than 100 and the p-value ranges are not simple multiples of .0100.

The righthand side of the table reports the bootstrap estimated probability that a min p-value less than or equal to that found in the analysis of computer intermediates would be found. To explain how this is calculated, for each bootstrap sample (plus the sample itself, which is taken as a draw), I order the test statistics for each test and assign them their rank, i.e. the number of bootstrap test statistics that are greater. This then allows me to calculate the distribution of the minimum G. All values of min(G) less than the G* found in the test of computer intermediates are instances where the p-value for computer intermediates would be greater than the minimum p-value. For cases where min(G) equals G*, I calculate the probability that the uniform u for computer intermediates would be less than the uniform

Table B1: Westfall-Young Multiple Testing Adjustment for Percentile Bootstrap Methods
Computer & Electronics Intermediates (t-likelihood)

	p-values in the single test				p-value adjusted for 4 test distribution			
bootstrap-c	.010-.020	.032-.042	.031-.041	.032-.043	.061	.118	.124	.151
bootstrap-t	.000-.010	.011-.021	.000-.010	.000-.011	.031	.074	.031	.032
subsampling-c	.021-.031	.085-.096	.054-.065	.068-.080	.113	.287	.215	.261
subsampling-t	.000-.010	.000-.011	.000-.011	.000-.011	.031	.032	.032	.034

u drawn for the other models. If, for example, there are 4 instances in M +1 draws where min(G) equals G* and 7 instances where it is less than G*, the probability the min p-value would be less than the p-value for computer intermediates equals (7+(3/4)*4)/(M+1). Since I calculate the probabilities across the distribution of uniform u's, the p-values given in the righthand side of the table do not specify a range.

As can be seen in the table, the p-values adjusted for the four test distribution are somewhat less than what would be found with a Bonferroni four times multiple of the upper range of the p-value in the test, but results relative to the .05 and .10 cutoffs are unchanged, as was stated in the paper. In almost all instances the -c results are not significant at the .10 level, while the -t results are generally significant at the .05 level. Simple Bonferroni multiplication by four of the min to max ranges in the lefthand side of the table leads to the same conclusions.

C. Table 8 for the Normal Likelihood

Table 8 in the paper showed that the estimated mismeasurement parameter with the t-likelihood varies relatively little if different known values of σ and ρ (and hence β^P & β^X) are imposed in the estimation. Table C1 below shows the same is true for the normal likelihood. This establishes that bias associated with the estimation of the βs is not the cause of the negative estimate of mismeasurement. However, as explained in the paper, estimated standard errors increase when the β are not allowed to vary across bootstrap industry samples and hence many of the estimates have absolute t-stats less than 2. As indicated in a footnote in the paper, t-stats of -2.2, -2.1, -1.9, -2.3 in the baseline specification with 0 through 3 lags and a normal likelihood become -1.8, -1.4, -1.7, and -1.9, respectively, if the point estimates of the β found in each specification are imposed on the subsequent bootstrap.

Table C1: Estimated Computer & Electronics Intermediates Mismeasurement Parameters for Different "Known" Values of σ and ρ (normal likelihood)

by ρ:	0	.25	.50	.75	1	2	5	10	1000	10^6
by σ						no lags				
0		-.44	-.44	-.44	-.44	-.44	-.44	-.44	-.44	-.44
.25	-.41#	-.46	-.46	-.46	-.45	-.45	-.45	-.45	-.45	-.45
.50	-.41#	-.46#	-.46	-.46	-.46	-.46	-.46	-.46	-.45	-.45
.75	-.41#	-.45#	-.47	-.47	-.47	-.47	-.47	-.46	-.46	-.46
1	-.41	-.45#	-.47	-.48#	-.48#	-.48	-.48	-.47	-.47	-.47
2	-.41#	-.44*	-.47#	-.49#	-.51	-.52	-.52	-.51	-.49	-.49
5	-.41	-.43#	-.47#	-.50#	-.54#	-.61#	-.57	-.53	-.48	-.48
10	-.41	-.43*	-.46#	-.51#	-.56#	-.68#	-.56#	-.51#	-.47	-.47
1000	-.41#	-.43#	-.46#	-.51#	-.59*	-.77*	-.53#	-.48	-.45#	-.45#
10^6	-.41#	-.43#	-.46#	-.51*	-.59#	-.77*	-.53#	-.48	-.45#	-.45
						1 lag				
0		-.47	-.47	-.47	-.47	-.47	-.47	-.47	-.47	-.47
.25	-.42	-.47	-.48	-.48	-.48	-.48	-.47	-.47	-.47	-.47
.50	-.42	-.47	-.48	-.48	-.48	-.48	-.48	-.48	-.48	-.48
.75	-.42	-.47#	-.48	-.49	-.49	-.49	-.49	-.49	-.49	-.49
1	-.42	-.46	-.48	-.49	-.50	-.50	-.50	-.50	-.49	-.49
2	-.42	-.45#	-.48	-.50#	-.52#	-.54#	-.54	-.53	-.52	-.52
5	-.42	-.44#	-.48#	-.51#	-.55#	-.64#	-.61	-.57	-.53	-.53
10	-.42	-.44	-.47#	-.52#	-.57#	-.72#	-.62#	-.56	-.51	-.51
1000	-.42	-.44	-.47#	-.52#	-.61*	-.84*	-.58	-.53	-.49	-.49
10^6	-.42	-.44#	-.47#	-.52#	-.61*	-.84*	-.58	-.53	-.49	-.49
						2 lags				
0		-.56	-.56	-.56	-.56	-.56	-.56	-.56	-.56	-.56
.25	-.52	-.58	-.58	-.58	-.58	-.57	-.57	-.57	-.57	-.57
.50	-.52	-.58	-.59	-.60	-.59	-.59	-.58	-.58	-.58	-.58
.75	-.52	-.58	-.60	-.61	-.61	-.60	-.60	-.59	-.59	-.59
1	-.52#	-.58#	-.61	-.62	-.62	-.62	-.61	-.60	-.60	-.60
2	-.52	-.57#	-.61#	-.64#	-.66#	-.68	-.67	-.65	-.63	-.63
5	-.52	-.56#	-.61#	-.66#	-.72#	-.82#	-.75#	-.68	-.62	-.62
10	-.52	-.55	-.60#	-.67	-.76#	-.93*	-.74	-.66	-.60	-.60
1000	-.52	-.55#	-.60#	-.69#	-.82*	-1.1*	-.69	-.62	-.57	-.57
10^6	-.52#	-.55#	-.60#	-.69#	-.82*	-1.1*	-.69	-.62	-.57	-.57
						3 lags				
0		-.42	-.42	-.42	-.42	-.42	-.42	-.42	-.42	-.42
.25	-.33	-.43	-.43	-.43	-.43	-.43	-.43	-.43	-.43	-.43
.50	-.33	-.42	-.44	-.44	-.44	-.44	-.44	-.44	-.44	-.44
.75	-.33	-.41	-.44	-.45	-.45	-.46	-.45	-.45	-.44	-.44
1	-.33	-.40	-.44	-.45	-.46#	-.47	-.46	-.46	-.45	-.45
2	-.33	-.38	-.43	-.46#	-.48#	-.52#	-.51	-.50	-.48	-.48
5	-.33	-.36	-.41	-.46#	-.51#	-.63	-.59	-.53	-.47	-.47
10	-.33	-.35	-.39	-.45#	-.53#	-.72#	-.58	-.51	-.45	-.45
1000	-.33	-.34	-.38	-.44#	-.55#	-.83*	-.53	-.47	-.43	-.43
10^6	-.33	-.34	-.38	-.44#	-.55#	-.83*	-.53	-.47	-.43	-.43

Notes: results based upon (9) augmented with lags as in (12), with the exception that β^P and β^X are not estimated, but rather taken as given by the values implied by σ and ρ. Absolute value of t-statistic (*) greater than 3; (#) greater than 2.

Table D1: Mismeasurement Associated with Computer Technology
Estimated Using Average and Period t Shares

	normal likelihood				t likelihood			
	no lags	1 lag	2 lags	3 lags	no lags	1 lag	2 lags	3 lags
				computer hardware capital				
average shares	-.36 (.56)	-.10 (1.1)	-.32 (1.4)	-.38 (1.1)	-.22 (.29)	-.10 (.18)	-.11 (.19)	-.07 (.22)
t shares	-.19 (1.1)	.05 (2.0)	-.12 (2.3)	-.27 (1.4)	-.21 (.27)	-.10 (.16)	-.12 (.20)	-.08 (.21)
				software capital				
average shares	.00 (.40)	.22 (.49)	.02 (.62)	-.39 (.69)	-.30 (.16)	-.11 (.18)	-.11 (.18)	-.10 (.21)
t shares	-.17 (.59)	-.01 (.68)	-.19 (.80)	-.54 (.82)	-.28 (.20)	-.11 (.19)	-.13 (.22)	-.11 (.24)
				computer & electronics intermediates				
average shares	-.49 (.22)	-.51 (.24)	-.64 (.33)	-.48 (.21)	-.48 (.12)	-.35 (.10)	-.44 (.13)	-.33 (.10)
t shares	-.45 (.22)	-.47 (.18)	-.59 (.23)	-.44 (.20)	-.45 (.12)	-.31 (.08)	-.39 (.12)	-.29 (.10)
				computer systems design intermediates				
average shares	2.8 (2.2)	4.2 (2.8)	3.5 (2.7)	2.2 (2.2)	.16 (1.1)	.30 (.87)	.18 (.72)	.17 (.63)
t shares	5.3 (3.0)	6.6 (3.5)	6.1 (3.7)	4.4 (3.0)	.42 (.98)	.61 (.75)	.48 (.64)	.45 (.54)

Notes: Mismeasurement parameters as in the systems estimation (9) in the paper, augmented with lag vectors as in (12). Bootstrap-se standard errors in () based upon 99 industry-clustered draws.

D. Sensitivity to Use of Factor Shares for Period t

In the paper I follow the Tornqvist indices used to calculate the BEA total factor productivity indices and use average t & t+1 factor shares in place of θ_{jit} and Ω_{jit}. Table D1 above compares the results reported in the paper with point estimates and standard errors found using period t factor shares as the regressors. Using period t shares, point estimates for computer & electronics intermediates shrink toward zero by about 10%, while estimates for computer and software capital using the t-likelihood are largely unchanged. Large proportional changes are found using the normal likelihood for inputs other than computer intermediates, and for computer systems design intermediates in general, but in these cases standard errors are very large relative to point estimates with average factor shares to begin with. These results were noted in a footnote in the paper.

E. Estimating Mismeasurement of Primary Factor Inputs

In the paper I estimate mismeasurement of what industries do with inputs (factor augmenting technical change). While this implies mismeasurement of the output of individual industries and hence, through the input output table, mismeasurement of intermediate inputs, I otherwise assume that primary factor inputs are measured correctly. As readers may question this, this appendix presents estimates of primary factor input mismeasurement.

We posit that:

$$\text{(E1)} \quad \hat{X}^T_{jit} = \hat{a}^{UO}_{jit} + \hat{X}^M_{jit}$$

where $\hat{X}^T_{jit}$ and $\hat{X}^M_{jit}$ are the true and measured growth of primary input *j* in industry *i* at time *t*, while $\hat{a}^{UO}_{jit}$ is the unobserved discrepancy between them. The discrepancy between true and measured total factor productivity growth is then:

$$\text{(E2)} \quad \hat{A}^T_{it} = \hat{A}^M_{it} - \sum_{j=N+1}^{J} \theta_{jit} \hat{a}^{UO}_{jit}.$$

The reader is reminded that the sequence of inputs 1 … *J* is composed of 1 … *N* industry indices and *N*+1 … *J* primary inputs. Assuming mismeasurement applies only to the quantity of input *j*, the solution of the demand and supply system examined in (6) and (7) in the paper can then be restated as the estimating equations on observables:

$$\text{(E3)} \quad \hat{P}^M_{it} = \beta^P [\hat{A}^M_{it} - \alpha_j \theta_{jit}] + \sum_{l=1}^{T} (L^P_{lP} \hat{P}^M_{it-l} + L^P_{lX} \hat{X}^M_{it-l}) + \eta^P_i + \eta^P_t + \varepsilon^P_{it}$$

$$\hat{X}^M_{it} = \beta^X [\hat{A}^M_{it} - \alpha_j \theta_{jit}] + \sum_{l=1}^{T} (L^X_{lP} \hat{P}^M_{it-l} + L^X_{lX} \hat{X}^M_{it-l}) + \eta^X_i + \eta^X_t + \varepsilon^X_{it},$$

where α_j is the economy-wide average rate of mismeasurement of the growth of input *j*, $\hat{a}^{UO}_{jit}$, and where, as in the paper, the η denote industry and year fixed effects and the *L* coefficients on lagged values of the dependent variables, with *T* = 0, 1, 2 or 3.

Table E1 reports the estimated α_j for all primary inputs in the BEA's total factor productivity accounts. Bootstrap-se standard errors are given in () and the min to max delete-one-industry coefficient range in []. The t-stats are at most 1.5, and usually well below 1.

Table E1: Mismeasurement of the Growth of Primary Factor Inputs
(each cell a separately estimated model)

	normal likelihood				t likelihood			
	no lags	1 lag	2 lags	3 lags	no lags	1 lag	2 lags	3 lags
computer capital	-.49 (.41) [-.73/-.34]	-.37 (.43) [-.64/-.26]	-.69 (.83) [-1.5/-.20]	-.63 (1.2) [-1.9/.16]	-.84 (.87) [-2.1/-.61]	-.56 (.81) [-1.4/-.42]	-.62 (1.0) [-1.8/-.40]	-.43 (1.3) [-1.9/-.18]
software capital	-.03 (.37) [-.16/.31]	.11 (.36) [-.01/.48]	-.23 (.66) [-.42/.68]	-.74 (.83) [-.99/.40]	-.80 (.69) [-1.1/-.50]	-.29 (.73) [-.54/-.08]	-.36 (1.1) [-.89/.01]	-.21 (1.2) [-.62/.23]
r & d capital	.33 (.36) [.03/.42]	.34 (.35) [.08/.44]	.40 (.46) [.00/.52]	.16 (.44) [-.27/.26]	.55 (.92) [-.79/1.1]	.39 (.79) [-.75/.90]	.18 (1.1) [-.96/.90]	.00 (1.2) [-.87/.75]
communications capital	.94 (.87) [.48/1.4]	.84 (.82) [.47/1.2]	.46 (1.1) [.11/1.0]	-.19 (1.1) [-.51/.51]	-.26 (2.4) [-1.0/.91]	.62 (2.0) [-.15/1.6]	-.35 (2.2) [-1.2/.36]	-1.4 (2.0) [-2.2/-.73]
instruments capital	.69 (1.8) [-.42/1.2]	1.6 (1.8) [.60/2.3]	2.5 (2.1) [1.2/3.3]	2.0 (1.9) [1.1/2.5]	-1.2 (3.0) [-2.7/-.25]	.53 (2.6) [-.57/1.1]	1.0 (2.9) [-.42/1.6]	1.2 (2.3) [.31/1.7]
transport equipment	-.38 (.41) [-.65/-.16]	-.36 (.44) [-.65/-.07]	-.36 (.58) [-.69/.11]	-.24 (.48) [-.46/.17]	-.34 (.78) [-.98/.03]	-.81 (.75) [-1.2/.06]	-.12 (.97) [-.73/.36]	-.24 (.96) [-.56/.36]
other equipment	-.04 (.48) [-.26/.13]	.15 (.54) [-.20/.32]	.22 (.65) [-.16/.44]	.14 (.67) [-.21/.37]	.22 (.29) [.11/.31]	.16 (.26) [.04/.22]	.47 (.43) [.39/.56]	.24 (.46) [.16/.35]
art capital	-.11 (.21) [-.19/-.03]	.01 (.26) [-.17/.12]	-.04 (.29) [-.25/.09]	.02 (.22) [-.17/.10]	.24 (.42) [.02/.56]	.43 (.50) [.15/.91]	.28 (.69) [.01/.81]	.26 (.79) [.08/.54]
structures capital	-.17 (.15) [-.21/-.12]	-.17 (.14) [-.21/-.12]	-.12 (.19) [-.18/-.05]	-.12 (.18) [-.20/-.06]	.05 (.14) [-.02/.09]	-.04 (.11) [-.09/-.01]	.08 (.16) [.02/.12]	.07 (.15) [.01/.13]
college labour	.22 (.16) [.14/.36]	.23 (.15) [.16/.35]	.29 (.21) [.20/.43]	.16 (.18) [.08/.27]	.12 (.20) [-.02/.17]	.19 (.21) [.08/.26]	.14 (.21) [.02/.23]	.06 (.23) [-.05/.14]
non-college labour	.12 (.15) [.08/.24]	.05 (.15) [.01/.17]	.09 (.22) [.02/.28]	.09 (.19) [.04/.26]	.15 (.14) [.09/.21]	.11 (.13) [.07/.16]	.09 (.16) [.06/.16]	.03 (.15) [.01/.06]

Notes: Mismeasurement parameters α_j as in (E3). Bootstrap-se standard errors in () based upon 99 industry-clustered draws; min-max delete-one industry coefficient range in []. 1416 observations without lags, reduced by 59 for each lag.

The delete-one-industry range is positive to negative in at least one specification for all inputs except for non-college labour, where the delete-one range nevertheless approaches zero. As reported in the paper, point estimates for computer capital and software capital are negative, but not statistically significant nor robust in sign to the removal of one industry from the sample in at least one specification.