Additional file 2

Dynamic modeling of yeast meiotic initiation

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Table S1 - The *rim11* knockout model

(2) $$\frac{dpUme6}{dt} = -u_{ume6} \cdot pUme6$$

(3) $$\frac{dpSok2}{dt} = p_{sok2} \cdot \frac{c_{sok2}}{c_{sok2} + \mathrm{Ime1}} \cdot (1 - pSok2) - u_{sok2} \cdot pSok2$$

(4) $$\frac{d\,\mathrm{Ime1}}{dt} = s_{ime1} \cdot \frac{c_{ime1}}{c_{ime1} + pSok2} - d_{ime1} \cdot \mathrm{Ime1} - d'_{ime1} \cdot \mathrm{Ime2} \cdot \frac{\mathrm{Ime1}}{c_1 + \mathrm{Ime1}}$$

(5) $$\frac{dp\,\mathrm{Ime1}}{dt} = -d_{pime1} \cdot p\,\mathrm{Ime1}$$

(6) $$\frac{d\,\mathrm{Ime2}}{dt} = s_{ime2} \cdot pUme6 \cdot p\,\mathrm{Ime1} + s'_{ime2} \cdot \frac{\mathrm{Ime2}^5}{c_2^{\,5} + \mathrm{Ime2}^5} - d_{ime2} \cdot \frac{\mathrm{Ime2}}{c_3 + \mathrm{Ime2}}$$

Table S2 - The *ume6* knockout model

(1) $$\frac{dRim11}{dt} = u_{rim11} \cdot (1 - Rim11) - p_{rim11} \cdot Rim11$$

(3) $$\frac{dpSok2}{dt} = p_{sok2} \cdot \frac{c_{sok2}}{c_{sok2} + \mathrm{Ime1}} \cdot (1 - pSok2) - u_{sok2} \cdot pSok2$$

(4) $$\frac{d\,\mathrm{Ime1}}{dt} = s_{ime1} \cdot \frac{c_{ime1}}{c_{ime1} + pSok2} - p_{ime1} \cdot Rim11 \cdot \mathrm{Ime1} - d_{ime1} \cdot \mathrm{Ime1} - d'_{ime1} \cdot \mathrm{Ime2} \cdot \frac{\mathrm{Ime1}}{c_1 + \mathrm{Ime1}}$$

(5) $$\frac{dp\,\mathrm{Ime1}}{dt} = p_{ime1} \cdot Rim11 \cdot \mathrm{Ime1} - d_{pime1} \cdot p\,\mathrm{Ime1}$$

(6) $$\frac{d\,\mathrm{Ime2}}{dt} = s'_{ime2} \cdot \frac{\mathrm{Ime2}^5}{c_2{}^5 + \mathrm{Ime2}^5} - d_{ime2} \cdot \frac{\mathrm{Ime2}}{c_3 + \mathrm{Ime2}}$$

Table S3 - The *sok2* knockout model

(1) $$\frac{dRim11}{dt} = u_{rim11} \cdot (1 - Rim11) - p_{rim11} \cdot Rim11$$

(2) $$\frac{dpUme6}{dt} = p_{ume6} \cdot Rim11 \cdot (1 - pUme6) - u_{ume6} \cdot pUme6$$

(4) $$\frac{d\mathrm{Ime}1}{dt} = s_{ime1} - p_{ime1} \cdot Rim11 \cdot \mathrm{Ime}1 - d_{ime1} \cdot \mathrm{Ime}1 - d'_{ime1} \cdot \mathrm{Ime}2 \cdot \frac{\mathrm{Ime}1}{c_1 + \mathrm{Ime}1}$$

(5) $$\frac{dp\mathrm{Ime}1}{dt} = p_{ime1} \cdot Rim11 \cdot \mathrm{Ime}1 - d_{pime1} \cdot p\mathrm{Ime}1$$

(6) $$\frac{d\mathrm{Ime}2}{dt} = s_{ime2} \cdot pUme6 \cdot p\mathrm{Ime}1 + s'_{ime2} \cdot \frac{\mathrm{Ime}2^5}{c_2^{\,5} + \mathrm{Ime}2^5} - d_{ime2} \cdot \frac{\mathrm{Ime}2}{c_3 + \mathrm{Ime}2}$$

Table S4 - The *ime1* knockout model

(1) $$\frac{dRim11}{dt} = u_{rim11} \cdot (1 - Rim11) - p_{rim11} \cdot Rim11$$

(2) $$\frac{dpUme6}{dt} = p_{ume6} \cdot Rim11 \cdot (1 - pUme6) - u_{ume6} \cdot pUme6$$

(3) $$\frac{dpSok2}{dt} = p_{sok2} \cdot (1 - pSok2) - u_{sok2} \cdot pSok2$$

(6) $$\frac{d\mathrm{Ime}2}{dt} = s'_{ime2} \cdot \frac{\mathrm{Ime}2^5}{c_2{}^5 + \mathrm{Ime}2^5} - d_{ime2} \cdot \frac{\mathrm{Ime}2}{c_3 + \mathrm{Ime}2}$$

Table S5 - The *ime2* knockout model

(1) $$\frac{dRim11}{dt} = u_{rim11} \cdot (1 - Rim11) - p_{rim11} \cdot Rim11$$

(2) $$\frac{dpUme6}{dt} = p_{ume6} \cdot Rim11 \cdot (1 - pUme6) - u_{ume6} \cdot pUme6$$

(3) $$\frac{dpSok2}{dt} = p_{sok2} \cdot \frac{c_{sok2}}{c_{sok2} + \mathrm{Ime1}} \cdot (1 - pSok2) - u_{sok2} \cdot pSok2$$

(4) $$\frac{d\,\mathrm{Ime1}}{dt} = s_{ime1} \cdot \frac{c_{ime1}}{c_{ime1} + pSok2} - p_{ime1} \cdot Rim11 \cdot \mathrm{Ime1} - d_{ime1} \cdot \mathrm{Ime1}$$

(5) $$\frac{dp\,\mathrm{Ime1}}{dt} = p_{ime1} \cdot Rim11 \cdot \mathrm{Ime1} - d_{pime1} \cdot p\,\mathrm{Ime1}$$

Table S6 - The pSok2-Ime1 feedback knockout model

(1) $$\frac{dRim11}{dt} = u_{rim11} \cdot (1 - Rim11) - p_{rim11} \cdot Rim11$$

(2) $$\frac{dpUme6}{dt} = p_{ume6} \cdot Rim11 \cdot (1 - pUme6) - u_{ume6} \cdot pUme6$$

(3) $$\frac{dpSok2}{dt} = p_{sok2} \cdot (1 - pSok2) - u_{sok2} \cdot pSok2$$

(4) $$\frac{d\mathrm{Ime}1}{dt} = s_{ime1} - p_{ime1} \cdot Rim11 \cdot \mathrm{Ime}1 - d_{ime1} \cdot \mathrm{Ime}1 - d'_{ime1} \cdot \mathrm{Ime}2 \cdot \frac{\mathrm{Ime}1}{c_1 + \mathrm{Ime}1}$$

(5) $$\frac{dp\mathrm{Ime}1}{dt} = p_{ime1} \cdot Rim11 \cdot \mathrm{Ime}1 - d_{pime1} \cdot p\mathrm{Ime}1$$

(6) $$\frac{d\mathrm{Ime}2}{dt} = s_{ime2} \cdot pUme6 \cdot p\mathrm{Ime}1 + s'_{ime2} \cdot \frac{\mathrm{Ime}2^5}{c_2^{\,5} + \mathrm{Ime}2^5} - d_{ime2} \cdot \frac{\mathrm{Ime}2}{c_3 + \mathrm{Ime}2}$$

Table S7 - The Ime2-Ime1 feedback knockout model

(1) $$\frac{dRim11}{dt} = u_{rim11} \cdot (1 - Rim11) - p_{rim11} \cdot Rim11$$

(2) $$\frac{dpUme6}{dt} = p_{ume6} \cdot Rim11 \cdot (1 - pUme6) - u_{ume6} \cdot pUme6$$

(3) $$\frac{dpSok2}{dt} = p_{sok2} \cdot \frac{c_{sok2}}{c_{sok2} + \mathrm{Ime1}} \cdot (1 - pSok2) - u_{sok2} \cdot pSok2$$

(4) $$\frac{d\,\mathrm{Ime1}}{dt} = s_{ime1} \cdot \frac{c_{ime1}}{c_{ime1} + pSok2} - p_{ime1} \cdot Rim11 \cdot \mathrm{Ime1} - d_{ime1} \cdot \mathrm{Ime1}$$

(5) $$\frac{dp\,\mathrm{Ime1}}{dt} = p_{ime1} \cdot Rim11 \cdot \mathrm{Ime1} - d_{pime1} \cdot p\,\mathrm{Ime1}$$

(6) $$\frac{d\,\mathrm{Ime2}}{dt} = s_{ime2} \cdot pUme6 \cdot p\,\mathrm{Ime1} + s'_{ime2} \cdot \frac{\mathrm{Ime2}^5}{c_2^{\,5} + \mathrm{Ime2}^5} - d_{ime2} \cdot \frac{\mathrm{Ime2}}{c_3 + \mathrm{Ime2}}$$

Table S8 - The Ime2 feedback knockout model

(1) $$\frac{dRim11}{dt} = u_{rim11} \cdot (1 - Rim11) - p_{rim11} \cdot Rim11$$

(2) $$\frac{dpUme6}{dt} = p_{ume6} \cdot Rim11 \cdot (1 - pUme6) - u_{ume6} \cdot pUme6$$

(3) $$\frac{dpSok2}{dt} = p_{sok2} \cdot \frac{c_{sok2}}{c_{sok2} + \mathrm{Ime1}} \cdot (1 - pSok2) - u_{sok2} \cdot pSok2$$

(4) $$\frac{d\,\mathrm{Ime1}}{dt} = s_{ime1} \cdot \frac{c_{ime1}}{c_{ime1} + pSok2} - p_{ime1} \cdot Rim11 \cdot \mathrm{Ime1} - d_{ime1} \cdot \mathrm{Ime1} - d_{ime1}' \cdot \mathrm{Ime2} \cdot \frac{\mathrm{Ime1}}{c_1 + \mathrm{Ime1}}$$

(5) $$\frac{dp\,\mathrm{Ime1}}{dt} = p_{ime1} \cdot Rim11 \cdot \mathrm{Ime1} - d_{pime1} \cdot p\,\mathrm{Ime1}$$

(6) $$\frac{d\,\mathrm{Ime2}}{dt} = s_{ime2} \cdot pUme6 \cdot p\,\mathrm{Ime1} - d_{ime2} \cdot \frac{\mathrm{Ime2}}{c_3 + \mathrm{Ime2}}$$

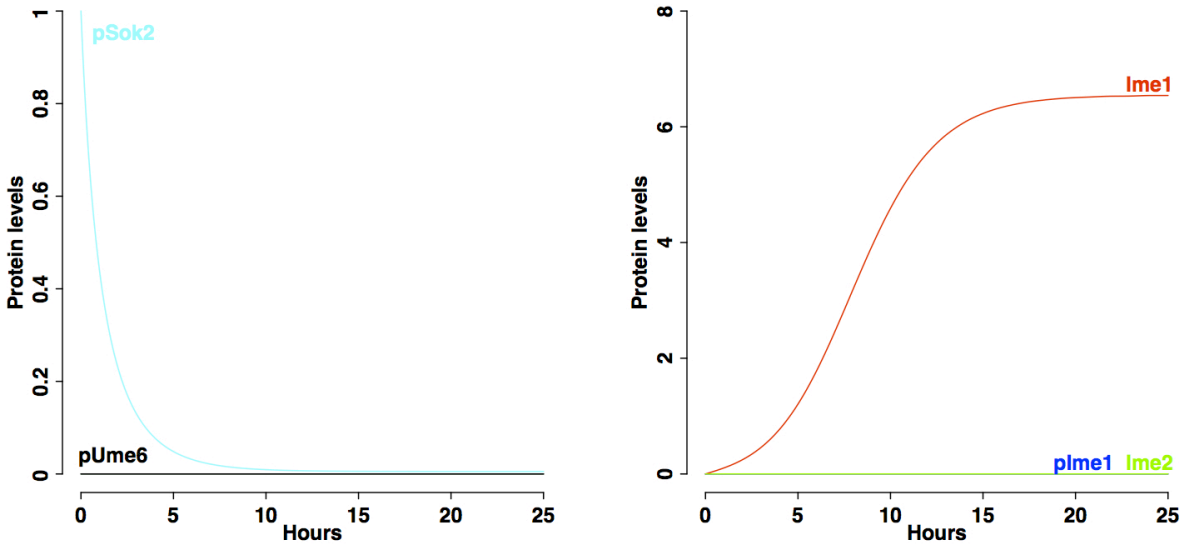

Figure S1 - Numerical simulations of the *rim11* knockout model

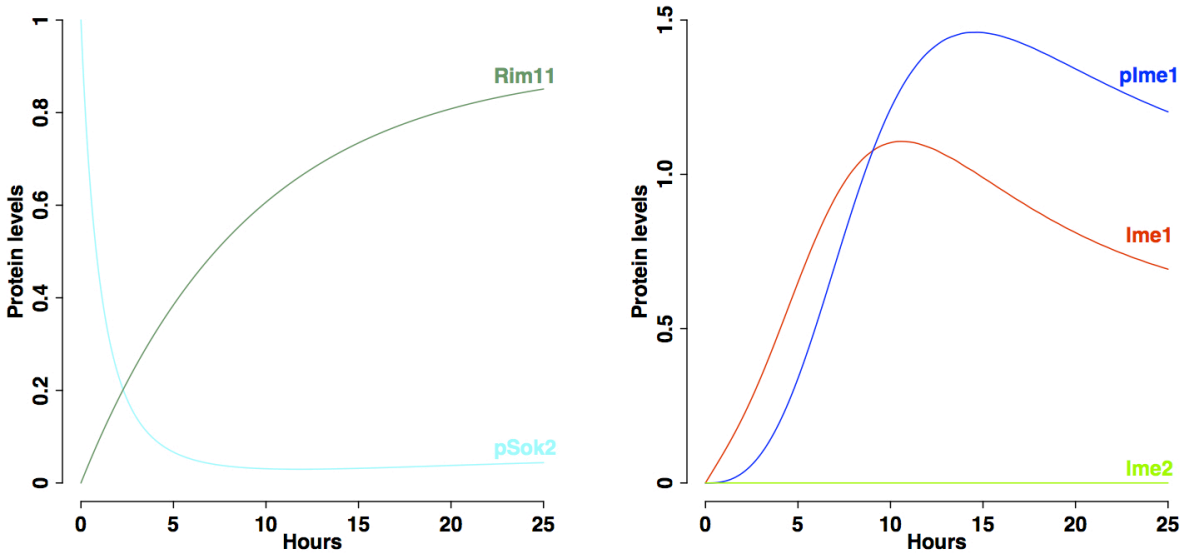

Figure S2 - Numerical simulations of the *ume6* knockout model

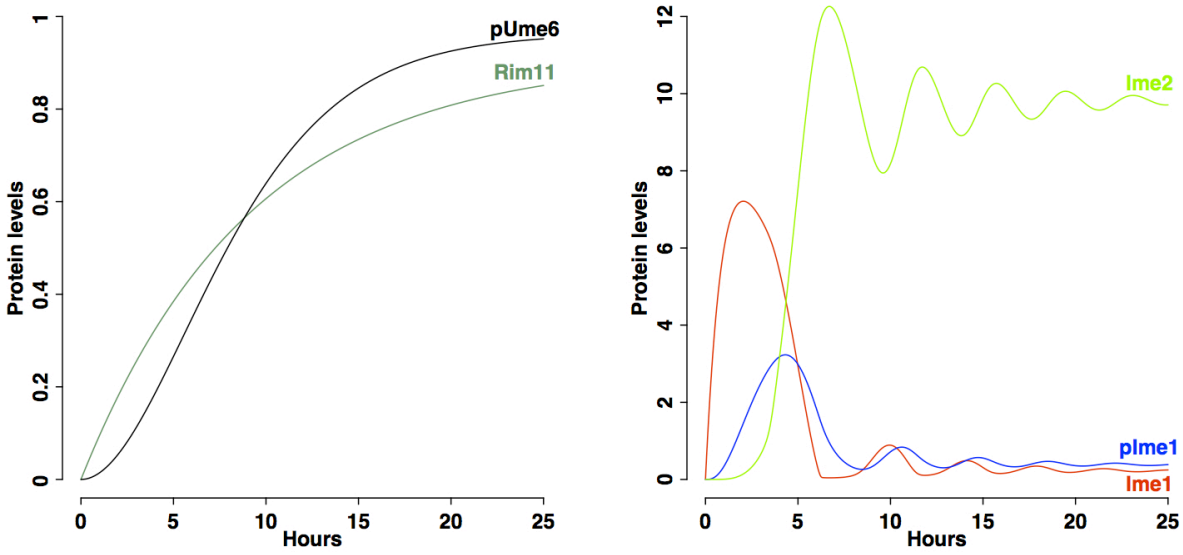

Figure S3 - Numerical simulations of the *sok2* knockout model

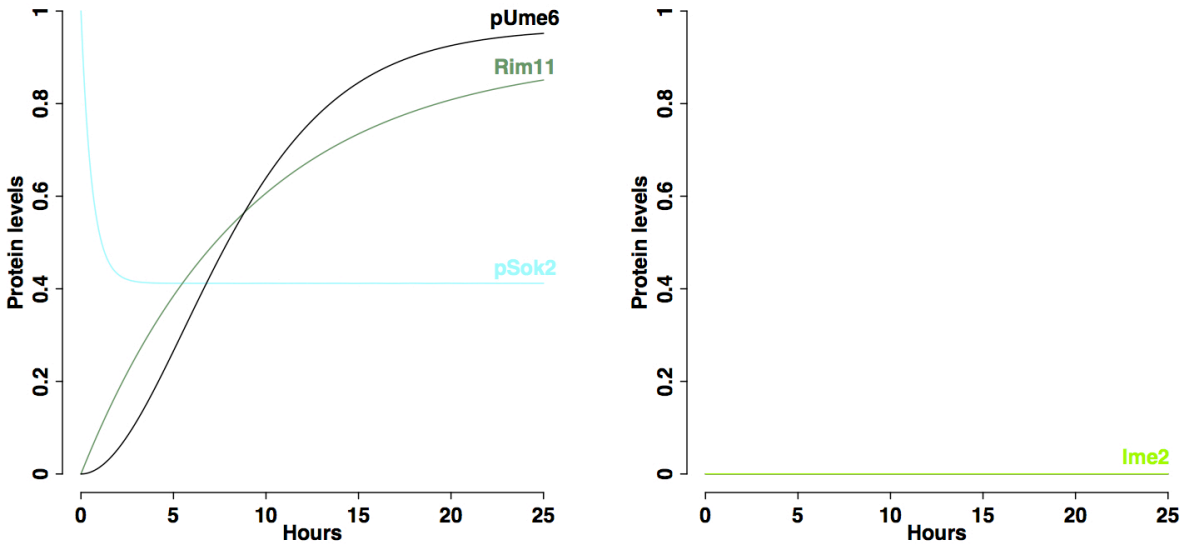

Figure S4 - Numerical simulations of the *ime1* knockout model

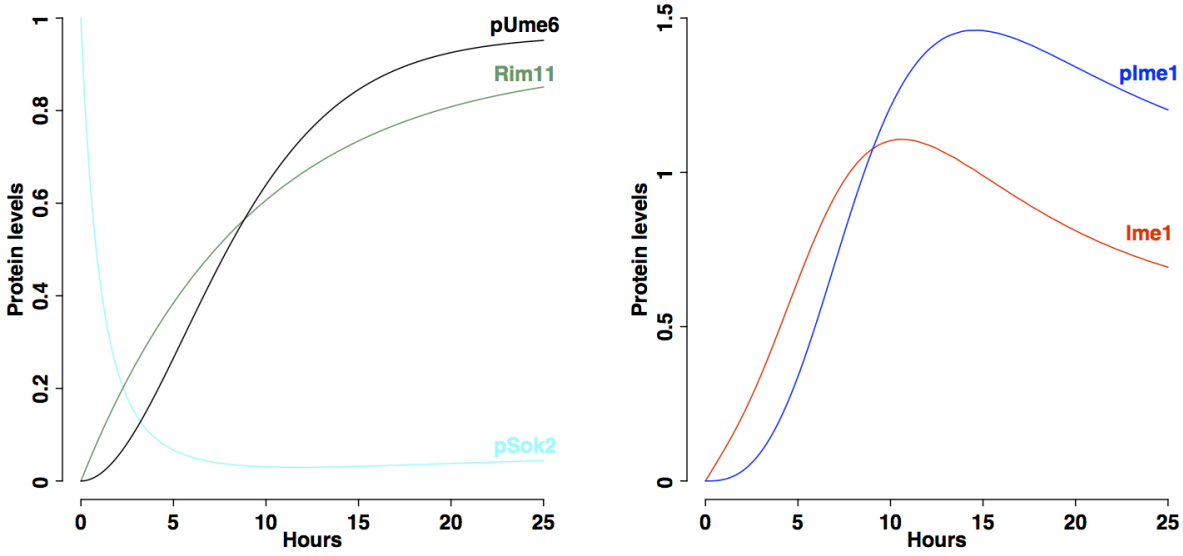

Figure S5 - Numerical simulations of the *ime2* knockout model

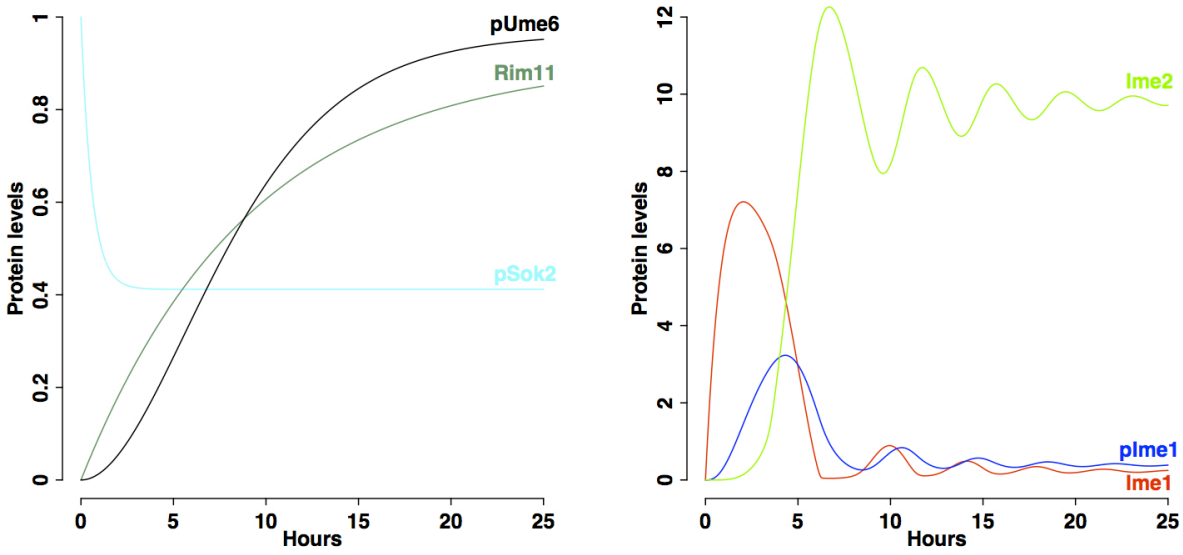

Figure S6 - Numerical simulations of the pSok2-Ime1 feedback knockout model

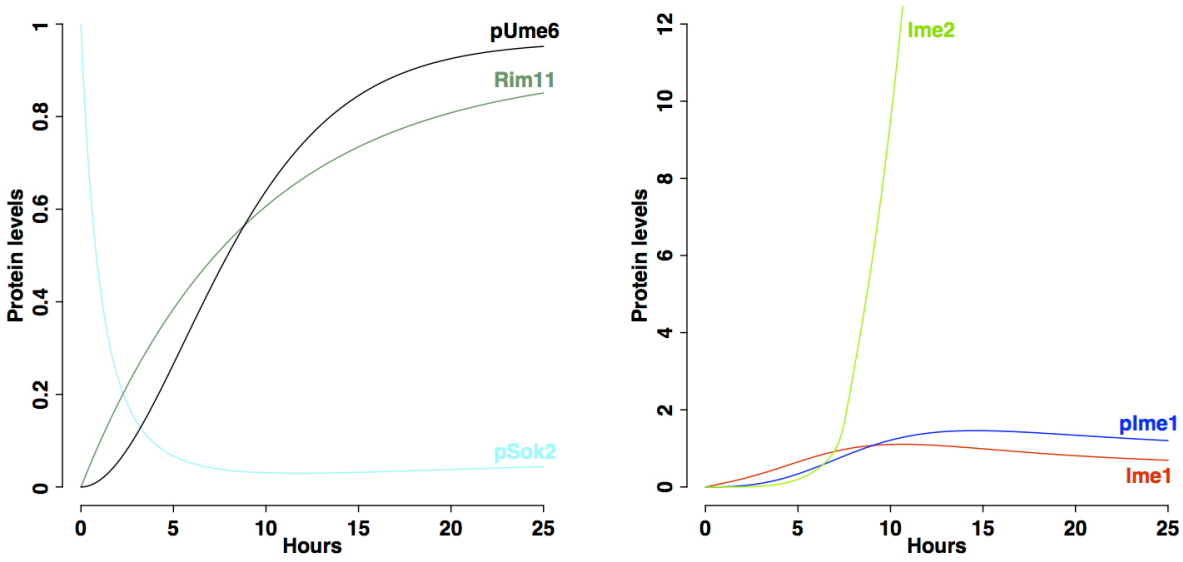

Figure S7 - Numerical simulations of the Ime2-Ime1 feedback knockout model

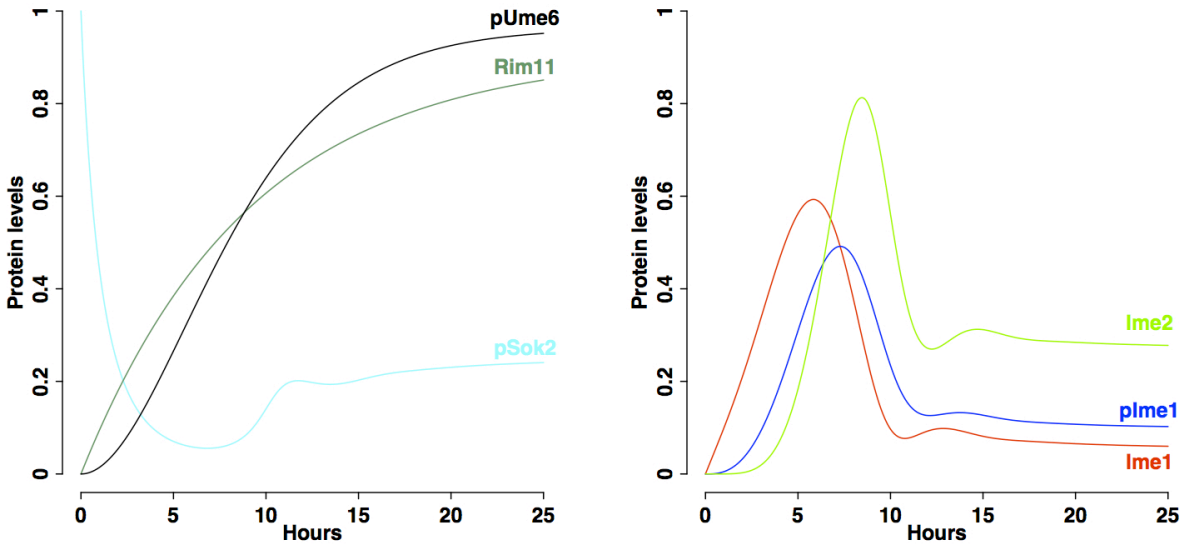

Figure S8 - Numerical simulations of the Ime2 feedback knockout model

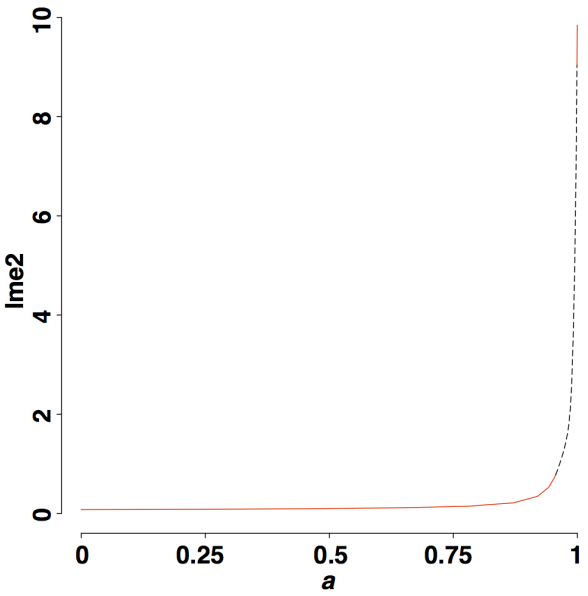

Figure S9 - Bifurcation analysis of PKA

Steady state value of Ime2 as a function of PKA. The change in PKA activity is represented by simultaneously varying p_{rim11} and p_{sok2}, phosphorylation rates of Rim11 and Sok2, respectively. This is achieved by varying a, where $p_{rim11} = 0.1 - 0.1a$ and $p_{sok2} = 7 - 7a$. Red segments represent stable steady states, whereas black segments trace unstable steady states.